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### SYMPOSIUM:

#### NASAL AND NASO-PHARYNGEAL CONDITIONS AS CAUSATIVE FACTORS IN AURAL DISEASE.

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#### NASAL AND NASO-PHARYNGEAL CONDITIONS AS CAUSATIVE FACTORS IN AURAL DISEASE.\*

BY G. A. LELAND, M. D., BOSTON, MASS.

That the nose is the source of all our woes was once stated as the caption of an article in a New York daily paper. That the nose and naso-pharynx are the source of a great majority of aural woes can hardly be gainsaid. For when we come to inquire into those conditions of the ear which conduce to discomfort, to abolition of the sense of hearing, and even, danger to life itself, it will be found that almost all have their morbid origin in this region. For with the exception of certain changes in the secretion of cerumen, which are said to be influenced by naso-pharyngeal circulation, whether exuberant or diminished; also of some markedly virulent cases of external otitis which may possibly pass through a thinned drumhead, and also of trauma, we can exclude largely external conditions as causative factors of middle ear disease.

So also as to invasions from the cerebral side. Trauma, as in fractures of the base, may cause middle ear complications, and aside

\*Symposium paper presented at the Joint Meeting of the American Otological Society of the American Laryngological Association.

from this, may be mentioned that still rarer factor, cerebrospinal meningitis which may invade the tympanum through the labyrinth. Thus we are confined in our consideration to the protean forms of middle ear diseases which have their origin in extension of inflammation and of infection from the naso-pharynx. And the reason for this extension must be found in loss of the protection normally provided for the safety and the integrity of the conducting apparatus of the organ of audition.

Now the ear is both the most delicate organ of the body, and the best protected. From without, it is fended from damage by a movable cushion, the auricle, set upon the hardest bone in the body; the membrane tympani, its outer limit, an inch and a quarter from the surface, approachable in the white races by a narrow curved canal, the inner two-fifths of which is of flinty hardness. From within it is protected by being at the outer end of a tube about one and one-half inches in length, whose inner mouth is about three inches from the outside. Thus by its position it is guarded from changes of temperature as well as from other sources of injury. Now as most diseases come from the inside, a brief consideration of this protective mechanism may be opportune and this may be arranged under two heads.

1. Structure of the Eustachian tube, its muscles and surroundings, and their physiological movements.

2. The influence of normal respiration, (Respiratory movements of membrana tympani.)

1. The Eustachian tube is a vertical slit in the side of the naso-pharynx, about one and one-fourth inches long, and about one-fourth inch high, whose sides except at the outer end as it emerges from the tympanum and at the inner opening in the pharynx, are when at rest in light contact. It is lined with columnar ciliated epithelia whose motion is downwards towards the pharynx. The posterior wall of the tube consists of a cartilage which curves over at the top so as to form a hook-like projection forward, below the anterior edge of which the anterior wall consists of a fibrous membrane or fascia which is attached to the anterior tip of the Eustachian cartilage continuous with its perichondrium, and extending downwards becomes part of the tendon of the origin of the tensor palati muscle. This muscle is the dilator of the tube, and would have been called so if it had not been named before Ruedinger described it and its action (Bezold). It has its origin in the anterior tip of the Eustachian cartilage and from the fascia of the anterior wall and then narrows to pass around the hamular process.

Another muscle is the levator palati, which has its origin in the petrous portion of the temporal bone and "its cylindrical belly runs along the floor of the cartilaginous tube" (Bezold) to be inserted into the soft palate.

Hovell describes a third muscle of the tube, the salpingo-pharyngeus or retractor of the tube, which, however, is not always present. It arises from the pharyngeal end of the cartilage and passes backwards and downward into the muscles of the pharynx.

The action of these muscles is obvious. The tensor palati pulls forward the anterior movable fibrous wall of the tube; the levator palati by its contraction swells its rounded belly upward and pushes upward the floor of the tube, and pushes backward the inner tip of the posterior cartilaginous wall. This action widens the pharyngeal mouth assisted, by the action of the tensor, which immediately follows. This pushing backwards of the tip of the cartilage is assisted by the third muscle, though a weak one.

In normal conditions therefore, every act of swallowing, most acts of speaking, and even those of respiration, as they cause movements of the very sensitive and flexible soft palate, also cause this continual opening of the inner mouth of the Eustachian tube.

We can conceive also that when active contraction ceases and the sides of the tube fall together again to a state of rest, the letting downwards of the floor, as the belly of the levator relaxes, acts as pumping or sucking, to draw air and moisture out of the tube, assisted by the elasticity of the drumhead itself.

Now, the inner opening of the Eustachian tube is situated in the midst of the lateral extension of the adenoidal ring of His or Heryng, and in the anterior wall of the tube between the fascia and the mucous lining is a mass of lymph glands. It will be readily seen that when the naso-pharyngeal glands are hyperplastic and hypertrophied and the mucous membranes are swollen because of their presence, the normal movements of the Eustachian tube will be curtailed and the circulation increased to even a pathological degree.

Hence the protection of the middle ear afforded by normal physiological ventilation and drainage will be lost. Hence will result rarefaction of the air in the middle ear spaces, depression of its only external movable part, the membrane tympani, the possible consequent effusions, serous or mucous or both, which may cause maceration of the inner walls, and so adhesions, which may take place without inflammation of a sthenic type, without pain, or invasion of germs, but producing the insidious variety of adhesive catarrh, which leads to loss of hearing sooner or later, becomes the

O. M. C. C. of middle and later life, and, which is amenable to treatment at any time, but curable only in the earliest stages.

Moreover, if the tube is covered in and pressed upon by adenoidal masses or swollen mucous membranes, so that the action of the cilia of the interior is in abeyance and the pumping motion lost, bacterial invasion may pass up the tube with so-called extension of inflammation, and then may follow inflammatory conditions O. M. A.; O. M. P.; O. M. P. C., with all the complications with which we are only too well acquainted.

Both the structure and physiology of these parts point out the rational method of treatment.

One of the greatest factors in the protection which should hedge about the organ of hearing, may be found in proper normal respiration, and that means *nasal respiration*, first, last and all the time. An English writer said long ago that the Eustachian tube begins at the tip of the nose. That meant that the air passages in front of the Eustachian orifices should be free. Mr. Mayo Collier, of London, has shown in an interesting brochure published some ten years ago, the great influence of nasal respiration upon the integrity of the upper air passages. Others have written on this subject, but as Collier's arguments are especially lucid, they may be mentioned here. There has been much said as to how the accessory cavities of the nose are kept clean, since at least two of these have their only exits near the top of thin bony cavities, (antrum of Highmore and sphenoid) and all of them have only very small exits. Collier shows that this is accomplished by alternate condensation and rarefaction of air, because the nasal orifices are very much smaller than the cavities to which they lead. The air passages, including the nose, pharynx, trachea, and lungs, contain a very large quantity of air, and this must be constantly renewed by alternate movements to and fro, through the small nasal orifices. In normal quiet respiration, at rest, twenty cu. in. of air must pass through these orifices twenty times a minute. By exercise or exertion, this may be increased to thirty cu. in. of air, thirty times or more a minute. It is obvious that on inspiration there must occur a partial vacuum behind the introitus nasi, and that on expiration the air pressure must be increased. And it is this alternate variation of pressure which causes an interchange of air through the foramina leading into the accessory nasal sinuses, and keeps the orifices clean. In this category may also be considered the middle ear cavity, for its ventilating tube is only somewhat longer than that of the frontal sinus.



That these respiratory movements actually take place was shown by Politzer in 1860 by the use of his manometer and has been shown by another European observer who was able to see these movements by covering the membrana tympani with an iridescent paint and using a magnifying glass for accurate observation.

The writer also had an experience which amply proved to his mind that these respiratory movements take place. Some years ago a laborer was admitted to the city hospital with large exostoses of the external auditory canal. On account of pain and deafness caused by accumulation of epithelial debris which could not be removed through the occluded canal, the exostoses were chiselled away after the removal of the cartilaginous and cutaneous canal. There was a perforation through the membrana tympani and the wound became infected. One morning, on removal of the packing, a bubble was formed over the canal orifice, which swelled out with expiration and was retracted with inspiration, which movements were constant till the bubble burst. His Eustachian tubes were apparently not abnormally open; but this observation and the experiments of others clearly show that there is a movement of air through the Eustachian tube, even though its walls are in apparent contact, and even though the force of the respiratory currents may not be very great.

From the foregoing may be deduced the rationale of treatment. Continuous nasal respiration is essential to the preservation of proper passages through the nose; that is, by the proper circulation of air through this region, proper circulation of the blood and lymph fluid is maintained.

Upon this also depends the normal condition of the naso-pharyngeal surfaces, and it is undoubted that the increase in the size of the lymphatic chain which surrounds the upper entrances to the body is largely caused by the lack of the proper play of air through the nose. Slight colds and carelessness of the medical attendants as well as of the parents allow the mouth to be used instead of the nose for respiration, hence the space not being needed is filled up by hyperplastic lymph masses, called adenoids. The proper movements of the Eustachian tubes are thus curtailed, and thus in earliest life is the foundation laid for deafness after the soft stage of life has passed, that is, after middle life. The time to cure, therefore, O. M. C. C., is *before* the initial earache has taken place or exudate has formed which causes depression and probably subsequent adhesions in the middle ear; and though in a very limited field there is no part of preventive medicine that can have more far-reaching

individual importance than the prevention of these initial earaches in the very young.

To this end almost universal education must be promulgated to teach people that their children must not be allowed to have earaches and the general indifference of the community to even a slight earache must be removed, for the middle ear never forgets it. Too many of us, and the writer speaks from personal experience, are suffering from this very neglect which took place in our earliest life, and it is a very serious question for the individual when he gets along in life to a position of some importance, at least to himself, if he finds that he is to be shut off from the activities and pleasures of life more or less, by the inevitable encroachment of almost irremediable deafness which could have been prevented had it been taken in time.

Hence the earliest symptoms of the presence of these growths must be a warning to us for their removal. Slight colds which are frequent and last a considerable time should call attention to the ears and if the drumheads are found to be dull and lustreless, the air in the middle ear having been diminished or lost, the naso-pharynx and especially the fossa of Rosenmuller should be immediately cleaned out and nasal respiration insisted upon. But supposing the earaches have already taken place, delays are dangerous at this stage, not only for the present, but more so for the future; and from what has been said, it seems deducible that the rational method of treatment even then is to clear out the naso-pharynx and fossa; that is, to hasten the mechanism of opening and shutting and pumping the Eustachian tube. To this end the sides of the naso-pharynx should be relieved of the growth which is inevitably present, for I am sure there is no child to be seen with earaches not caused by an injury, where adenoids are not present; with the possible exception of the infections of the exanthemata and of influenza; and even here it is doubtful.

To possibly throw some light on this point, my assistant, Dr. Henry Tolman, Jr., examined last week 127 cases in the scarlet fever wards at the Contagious Department of the Boston City Hospital. It is well known that this disease often, if not always, causes an increase in size of these naso-pharyngeal lymph tissues. I was surprised to find that he found forty-three cases without adenoids. There were eighty-four cases with adenoids and of these it is again surprising that there were seventy-two without aural complications either past or present. Of the twelve cases with aural complications, acute or chronic, all had adenoids, and of these only five had them generally distributed and the other seven had them only in the fossae

of Rosenmuller. This bears out my reiterated statement that children with earaches always have adenoid growths, and further emphasizes the importance of a clear fossa of Rosenmuller.

It has been the writer's privilege in numerous cases on the coming of earaches to scrape out the fossae of Rosenmuller and the sides of the naso-pharynx at the mouth of the Eustachian tube, and to have others do it under his direction in the hospital. In almost every instance (I recall no exceptions) drainage has been established, inflammation of the ear has gone down, and perforation, pathological or artificial, was not necessary. Of course, this procedure which looks barbarous cannot be done in every instance. Unfortunately, we have to defer to the opinions, whims, and prejudices of guardians and parents, but in those instances where I have been given permission to do it, or where the more formidable ether operation has been allowed, the immediate removal of these growths from the naso-pharynx has been followed by an immediate subsidence of inflammation in the middle ear, both in children and adults.

Hence with this etiology in view, the rhinologist evidently is the most natural aurist for the beginning of these cases. Now if these cases have been allowed to run on and the insidious variety of adhesive catarrh has commenced to take place, with or without adhesions, the most rational treatment is that aimed to establish the proper physiological movements of the pharyngeal mouth of the Eustachian tube. From what has been said, it will be recalled that the mouth of this tube is never at rest; that its continuous movements tend to renew the air in the middle ear; but that if the side of the pharynx is swollen and especially if there is present a mass of adenoidal tissue, the older the tougher, or of adhesive bands or cicatricial tissue in the fossae of Rosenmuller, the pushing back of the tip of the tube by the levator palati, and the pulling back by the retractor of the tube cannot take place. Hence the proper movements are curtailed. Formerly the customary treatment in these cases was by inflation of the middle ear by the Politzer method, or by the use of the catheter; also by means of tragus massage after Hommel's method, aiming thus to keep up the mobility of the drum-head. In most of these cases lasting improvement did not take place, and could hardly be expected when these grosser methods of inflation were applied only once or twice a week; and it is a question whether the use of Politzer's bag is not injurious because it is usually used with so much force and because these forceful methods produce an overstretching of the membrana tympani and middle ear structures.

The proper method, therefore, in the writer's opinion, is to establish the physiological movements of the air, and to this end must be restored the integrity of the region of the mouth of the Eustachian tube. The fossae of Rosenmüller must be kept clean and wide, so as to permit the proper excursions of the posterior lip of the tube. Therefore, it may be said that the operation for the removal of adenoidal vegetations in whatever time of life it is performed, is far from complete and in fact utterly useless where adenoids are removed only for the restoration of the respiratory space, and not for the restoration of proper movements at the sides of the nasopharynx; i. e., utterly useless as far as the ear is concerned.

Moreover, one result of the operation in this fossa which is a sulcus narrowing at depth outwards, and which by the rhinoscope may appear but one-fourth inch deep, but which by the use of the finger may be found to be one-half inch or more in depth, is to wound its surfaces. Hence as these surfaces are movable, there is a tendency for the production of adhesions so that sooner or later after the operation, this fossa will be found to be occluded by fibrous tissue or by a reproduction of adenoids which it is a fact are absolutely impossible of complete removal, especially in this locality. Hence, in order to keep these fossae clean so to insure their proper movements, it is occasionally necessary to scrape them after the major operation, if they need it, and to make application of astringents in them soon afterwards to keep the adhesions from forming.

Now it is evident that such subsequent treatment is difficult of accomplishment; but it is also evident that in many cases it will be necessary if the proper movements of this tube are to be established and hearing preserved; that it is without doubt, much better to suffer a few weeks of uncomfortable treatment, than it is that the rest of life after middle age or earlier, should be compromised by increasing deafness.

But the obliteration of this fossa more or less complete is not confined to early life. It frequently obtains also in adults with increasing deafness, and compromises the proper movements that establish ventilation of the middle ear. It seems to the writer much more rational to re-establish proper movements of these parts whereby the patient treats himself by the motions of swallowing, and by movements of respiration, twenty to thirty times a minute, than it is to rely wholly on the use of the catheter or Politzer's bag. I beg to submit that this auto-treatment is much more effective where the middle ear has not been too firmly bound down by ad-

hesions than any other treatment which can be artificially applied. To emphasize this position might be cited numerous cases which have been formerly under treatment for many years, where the re-establishment of these palatal and respiratory movements has brought the ear back to a satisfactory degree of hearing and given the patient much greater comfort and a brighter outlook in life.

In one case a man of sixty years of age, where a diagnosis had been made of ankylosis of the stapes and the patient after twenty-five years of treatment had been given over to that hopeless state where further treatment was considered useless, the establishing of these movements brought back hearing so that it was considered by his family that he had been restored to his normal condition.

Another case of fifty-eight years of age, after the same length of former treatment, had been given over to *occasional observation* without treatment which was considered hopeless interference. The hearing has been restored from one inch right ear and one-half inch left, to between one and three feet right ear, and one-half to one foot left, for Politzer's acoumeter. Here general conversation at the table had been wholly lost, but now there is comfort at the table and in the office which had been unknown for years.

Another one, a man of sixty-four years of age, after forty years of ordinary methods of treatment, finally consented to have his nose restored, the swellings of his naso-pharynx reduced, and so was brought into a condition where intercourse with his fellowmen has now become a comfort when formerly it was a trial.

The reason which may be given for this difference in these cases is deduced from what has been said above and here reiterated, that the proper respiratory and naso-pharyngeal movements are operative twenty-four hours in each day, twenty or more times a minute, and that these very gentle movements of the drumheads tend to stretch or make flexible the stiffened membrane and even the adhesions, just as continual dropping of water may wear away the rock. In the writer's opinion, this rational method of treatment has given better results in cases of encroaching deafness than are produced in any other way; and that in many cases, this treatment must be insisted on at the very beginning of life.

There is one form of disease in which as yet very little progress has been made, viz.: oto-sclerosis. May it not be true that even this disease, started by inflammatory attacks in early life, influenced by rheumatism and other dyscrasias, may be prevented with all the rest by rational treatment of the naso-pharynx, *before these inflammatory attacks are begun?*

Dependent on the nose and throat may be mentioned several isolated symptoms, and the first is pain. Many patients come to us complaining of earaches where, after careful examination, there is no evidence of inflammatory mischief in the middle ear or its annexes. This pain is therefore reflex and may come from various locations, even from the aryepiglottic folds or from the sides of the larynx, as was shown many years ago by our colleague, Dr. J. Orne Green. Most frequently it comes from the tonsils, radiating upward. It occasionally comes from swelling of the posterior pharyngeal lymphatic bands behind the posterior pillars of the fauces, which pass up around the region of the Eustachian tubes. It may come from a tooth painful because of decay or improper striking, for any part of the tri-geminal in its myriad branches may have the cause of pain which may be referred to any other part. Also we may have pain in the ear from intra-nasal pressure, from suppuration of the sphenoid, and probably also the ethmoid, but this only shows that in some cases the whole periphery or whole nervous supply must be overhauled to find the cause.

The second symptom of this nature is a feeling of fullness in the ear, as if there were a plug of cotton, the removal of which would clear up this condition of discomfort. I have found this pressure feeling to be only a lesser degree of that which means pain, and to be caused in a large number of cases by pressure of the corresponding second turbinal upon the top of the third, or on the outer wall. The removal of this pressure clears up the feeling of plugging and it is utterly irrational to inflate the ear in these cases, for in most of them hearing tests will prove that the ear being all right, there can be no cause for the sensation there.

The third symptom is tinnitus; and especially, the low-toned roar, often with pulsations, or as the patient describes it, a hammering. In these cases there is frequently an effusion in the middle ear, but as often, the tympanum is clear. That this variety is often due to hyperaemia of the lymphatic structures in the sides of the nasopharynx, and especially in the fossae of Rosenmuller has been abundantly proved by its almost immediate cessation after they have been cleared out and kept clean by astringent applications, often necessarily made with considerable force. So also the hissing variety of tinnitus, especially in early or even middle life, is often, though less surely, diminished or abolished by reduction of the circulation around and inside of the mouth of the Eustachian tube. And to this end, for a result more or less permanent, let it again be reiterated that normal, unobstructed nasal respiration must be established;



and further that that most common of all nasal obstructions corrected, viz., the vicious habit of mouth-breathing.

The fourth and last symptom here to be noted is vertigo. The occlusion of the nose with its hyper-circulation is occasionally responsible for this symptom, even without active aural lesions. An old habitue of the aural service many years ago is well remembered, who for several months came to the clinic, led by his daughter, because of staggering in the street. He was treated aurally by me three to four months with little relief, by my colleague for the next six months, and was still coming in the same way when the service was changed. Then it was discovered that his turbinates, lower and middle, were much engorged. On reduction of these bodies the vertigo ceased and hearing improved. This case has served good stead as a pointer to occasional cases of nasal vertigo.

In speaking of these functional movements, those produced by blowing the nose have not been mentioned, because it is considered together with the Valsalvan experiment, a pernicious practice, resulting too often in over-stretching of the membrana tympani and of the middle-ear tendons and ligaments, and because proper treatment and proper use of the nose should make the use of the handkerchief unnecessary; for there is no doubt that this act increases congestion and intensifies most morbid conditions.

In closing it must be conceded that the whole subject has by no means been touched upon in this paper—it is too large for the time allotted—that many of the diseases of the ear, of inflammatory and infectious extensions, have been only hinted at; but it has been attempted to call attention to certain principles which have been of value as stimuli in practice, and to certain methods which have been followed by satisfactory results. Nor is it thought for a moment that anything new has been brought forward, anything outside of the practice or experience of most, if not all, of this audience of specialists; but only that this paper is a small part of this symposium which, with its discussion, is to go out to do missionary work among the family physicians, and especially the pediatricists, and even the obstetricians, who have to do with the youngest victims of these troubles, when treatment is most effective for the future as well as for the present; and also to make clear that treatment of the nasopharynx especially operative treatment, is in the province of the aural specialist, since its effect on the function of hearing is of the utmost importance.



## NASAL AND NASO-PHARYNGEAL CONDITIONS AS CAUSATIVE FACTORS IN AURAL DISEASE.\*

BY NORVAL H. PIERCE, M. D., CHICAGO.

Aural disease may be caused by pathological conditions in the nose and pharynx, including the epipharynx, in three ways: First, mechanically, by pressure on the tube or by interference with its ventilating mechanism. Second, indirectly (a), by hyperemia and stasis (collateral edema) which, by extension, reaches the middle ear from the nose and pharynx; (b), by toxins formed elsewhere which are transported to the ear without the presence of micro-organisms; (c), Reflexly, by way of the nervous mechanism, as in the otalgias accompanying tonsillar calculus, elongated styloid process, granular pharyngitis, etc. Third, directly, by the transportation of inflammatory incitants from foci established in the nose and throat.

The consideration of the subject may be approached from a pathological, anatomical or clinical viewpoint. From all standpoints, the greatest importance attaches to hyperplasia of the lymphoid structures constituting the upper portions of Waldeyer's ring. The nature, anatomical relations and symptomatology of these structures cannot be exhaustively studied in this paper for obvious reasons. It is sufficient for the present purpose to say that besides the large mass of lymphoid tissue situated on the posterior and upper wall of the epitympanic space known as adenoids, there are smaller groups of the same tissue situated in Rosenmuller's groove, in the nasal chambers, especially along the floor, scattered over the soft palate and, most important, within the Eustachian tube itself. Not always is it the volume of adenoids alone that interfere with tubal ventilation, either by stopping up the tube or by pressure interfering with the ventilating apparatus, but this is in large part due to the qualities of tenacious mucus which is extruded by these growths as a result probably of inflammatory action. The same may be said of these growths as they interfere with respiration. It is a well-known fact that the greatest annoyance in this regard occurs at night. During the daytime respiration may be much more normal, because gravity assists in draining the mucus into the mouth and esophagus. At night, however, this is no more operative, on account of the recumbent position; the tenacious mucus accumulates in the choanae and post-nasal spaces, and the individual is forced to breathe

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through the mouth. As deep sleep approaches, the tongue sinks back in the mouth and is eventually aspirated against the soft palate. Respiration becomes impossible and the victim, awakened by suffocation, adjusts the tongue, sinks again to sleep, only to experience a repetition of the torment. No wonder these little sufferers are disturbed by fearful dreams, frequently accompanied by enuresis.

On account of the nasal stoppage, food is hastily taken and insufficiently masticated, for the mouth must be used for breath. Because of some subconscious impulse, perhaps, the very desire for food is lessened.

The poor suckling fares especially hard. He cannot nurse and breathe at the same time, and his puny protests at this unfair fate, as well as the cachectic condition into which he falls, if not relieved, have been witnessed by us all. Children with adenoids and enlarged tonsils are under-nourished; they arise from their troubled sleep unrefreshed; they arrive at school already weary; add to this defective hearing and the superimposed nervous strain by which they endeavor to overcome the defect, and we have an explanation of their mental backwardness that is at least as satisfactory as Guye's elaborate hypothesis of *aproxia nasalis*. You may regard this as an unwarranted digression, but I have thought it wise in order to emphasize the fact that these children are most liable, not only to aural, but to all other infections.

Whether because of mucus in the Eustachian tube or because of the mechanical stoppage of the tube by the mass of adenoids in the epipharynx, or within the tube itself, or because of pressure in the cushion interfering with the ventilating apparatus, certain well-defined conditions result within the cavum. The tympanic membrane is displaced inwards, and with it the ossicular chain. In consequence, the equilibrium of the conducting apparatus, which normally is capable of movements at the foot-plate of the stapes far beyond our present power of microscopic measurement, is disturbed, and a loss of audition results. The cause of this displacement is generally ascribed to a loss of atmospheric pressure in the cavum, the plus atmospheric pressure in the external auditory canal being exerted against the tympanic membrane, pressing it inward. To the writer's mind, however, this is not a closed question.

Bezold regards the cavum as a modified pulmonary vesicle, which, while changed to the extent of containing a portion of the auditory apparatus, retains its ancient power of absorbing oxygen and throwing off carbon dioxide. This can hardly account for the great retraction of the tympanic membrane we find in some cases. The

capillaries are incapable of absorbing so much oxygen. In the lung, four-fifths per volume remains after respiration. To account for a greater rarification, Koerner likens the process which occurs in the cavum to that which takes place in the resorption of a pneumothorax by the pleura, and ascribes to the lymph spaces in the epithelial cells of the mucosa the greater part of the absorption of the gases. When we recall how completely a pneumothorax may be absorbed and the pleural vacuum re-established, the latter hypothesis seems more reasonable. Whether or not contraction of the tensor tympani contributes to the retraction of the tympanic membrane in recent cases is, in the writer's opinion, an unsettled question. Surely, there are cases of short duration, in which even by forcible inflation with the catheter, the membrane does not resume its normal contour or position. The writer has advanced the theory that the plus carbon dioxide, if we accept Bezold's theory, would tend to cause contraction of the muscle. Against this has been brought the fact that the tensor is isolated from the cavum in its canal, only the tendon projecting into the cavity of the drum, and that further it has its own blood supply. Still it may be urged, if the plus carbonic acid gas is absorbed by the lymph spaces of the epithelium covering the tendon and about that portion of the muscle nearest the cavum, a sufficient plus quantity may be conveyed to the muscle itself to cause contraction.

Your secretary, when he invited me to take part in this symposium, expressed the hope that I would be practical in my method of treating the subject. I fear, as he sits there listening, he must experience a sense of disappointment. But at the expense of adding to this disappointment I feel constrained to dwell upon another subject that must be regarded as unsettled. We must accept the clinical fact that the sinking-in of a drumhead is caused by insufficient ventilation due to tubal obstruction, but it is a question whether the exudates that frequently accompany the same condition can be regarded as of purely mechanical origin. The condition as it occurs in the brain—*hydrops ex vacuo meningeus*—cannot be used as a comparison, as there the brain mass shrinks in a cavity with unyielding walls. It may better be compared to the exudative process as it occurs in meningitis serosa or in pleural exudates. Years ago, the writer proved that the serous aural exudates, especially as they occur in young children, with tubal stoppage, were not only sterile, but were occasionally possessed of a certain bactericidal power (*Journ. American Med. Assoc.*, December 9, 1906). Notwithstanding this, it is more in accord with general pathology to assume that serous exudates result from inflammatory agencies, if not directly, at least indirectly; if not from direct bacterial invasion

of the tissues involved, at least indirectly from the action of bacterial toxins elaborated elsewhere, as in the case of the two instances quoted for comparison. This has been proven in reference to some aural manifestations as they occur in connection with the pharyngeal invasion of the bacillus diphtheriae.

If this view of the subject is accepted, then the term *hydrops ex vacuo meningeus* is no longer tenable, and should be dropped from our nomenclature.

Tubal obstruction as it occurs from hyperplasia and bacterial invasion of the adenoid tissue in the pharynx and epipharynx forms the keystone of a great part of aural pathology. If early operative assistance is extended to these cases, the results are most brilliant and lasting, yet not a few require after-treatment by means of inflation, massage, local applications, etc. The neglected cases form no inconsiderable number of those instances of defective hearing in adult life, where the changes in the aural apparatus are permanent. Among these may be mentioned: malposition and malformation of the conducting apparatus, adhesions, atrophy of the membrana tympani, luxation of the long process of the ambos from the head of the stapes, stapes ankylosis, spontaneous rupture of the membrane with consecutive cholesteatoma formation. In not a few cases of chronic aural suppurations has the removal of hyperplastic tonsils and adenoids been followed by a cessation of the discharge.

Here I wish to state the belief that nasal obstructions *per se* do not cause aural disease, as witness those cases of congenital atresia of the choanae in which the auditory apparatus remained normal for years, or the cases of post-nasal fibroma, in which the ear is unaffected until pressure necrosis causes a breach in the surface continuity of the tumor, and hemorrhage, accompanied by inflammatory phenomena, or cases of nasal polypi in which the ears are unaffected, occurs.

I am reminded further of one of my guides in a recent hunting expedition in New Brunswick, whose hearing, in spite of a pronounced septal deviation, was much more acute than mine, although he was nearly twenty years my senior.

There must always be, in addition to the purely mechanical obstruction, inflammatory factors present to produce disease of the middle ear that is of nasal origin. In saying this, I do not wish to be understood as underestimating the importance of nasal obstruction as an indirect and important factor in the production of aural disease. Every constriction within the nose, whether it be bilateral or unilateral, may cause hyperemia and disturbance of nutrition in the tissue back of the constriction, by reason of the rarification of air which occurs there. Such constriction is caused by

collapse of the alae of the nose, due to paresis of the levators, which occurs in mouth-breathers. Deflection of the septum acts in the same way, as do hypertrophies and turgescences of the turbinated bodies, especially when accompanied by excesses in eating and drinking. These individuals are constantly "taking cold." The chronic hyperemia and the disturbances of nutrition behind these constrictions render the tissue less resistant to bacterial invasion, so that each acute exacerbation is liable to be followed by invasion per continuity of surface of the tube and cavum, as well as the accessory sinuses.

These sinuses are not infrequently unsuspected depots for the distribution of infections material in aural disease. Everywhere, however, we see bacterial life playing the paramount role, due, it may be in many cases, to the lowered resistance of the nasal mucosa, caused by nasal obstruction. But this leads me to say that not infrequently the same conditions may be brought about in the nasal mucosa which lead to affections of the ear by errors in living, excesses in drink, lack of fresh air and exercise, overwork, worry, and the thousand unnatural shocks that our artificial life is heir to. And, further, clinical experience teaches that if the inflammatory factors are not superadded to nasal obstruction, these may be most extensive and pronounced without the occurrence of aural disease.

In conclusion, I shall take this opportunity to raise a protesting voice against the widespread and irrational removal of slight irregularities of the septum and turgescence turbinated bodies in the mistaken belief that such slight irregularities play a considerable part in the production of aural disease. The idea of nasal insufficiency has been carried to unwarranted extremes by many operators, and no little unnecessary suffering has been caused by their misguided enthusiasm. In not a few instances which have come to my observation have these operations been performed on patients whose conducting apparatus had been long before permanently injured by previous pathological processes, the results of which are atrophy of the tympanic membrane, malformation of the malleus, dislocation, adhesions, etc. I have been especially impressed by the unnecessary nasal and pharyngeal operations undertaken with the vain hope of relieving cases of uncomplicated oto-sclerosis—a disease that has no etiological relationship with nasal obstructions. Let us remember that the anemic, overworked clerk may need fresh air, nutritious food and fair fields more than our turbinate scissors—the irritable neurasthenic other treatment than our nasal saws.

I wish to thank you for so patiently bearing with me, in taking up so much of your time in discussing this well-worn subject.

31 Washington Street.

## NASAL AND NASO-PHARYNGEAL CONDITIONS AS CAUSATIVE FACTORS IN AURAL DISEASE.\*

BY D. BRADEN KYLE, M. D., PHILADELPHIA, PA.

In discussing this interesting subject, the natural course of procedure would be first, to classify the causes. In the first place, experience teaches us that few aural conditions are primary, so the first natural classification of nasal conditions affecting the ear would be primary and secondary, or one which would be equally good would be direct and indirect. In considering this subject from any standpoint as to classification, it is not my aim to take up any conditions other than those described by the title, as primary lesions of the ear, in no way associated with pharyngeal or nasopharyngeal conditions, certainly do not come under this heading.

Many nasal, nasopharyngeal and pharyngeal causes would be placed under the classifications mentioned above. Yet, different stages of different conditions might change the classification as to cause,—an indirect, might become direct, a secondary condition might really be a primary one, as far as the ear is concerned. An equally good classification would be a physiological one, where from physiological causes, nasal conditions causing obstruction to the passage of air might involve the ear secondarily. Another excellent classification would be *mechanical*; for example, where there is inequality in the size of the nostril, or by the direction of the current of air, or by the presence of a foreign body, a mechanical irritation is set up and an ear lesion follows. Where malformations exist, such as narrow nasal orifices, malformation of the nasal bones, irregularity as to the formation of the structures, probably due to some physiological cause such as adenoids, nevertheless such conditions would be classed as an *anatomical* cause. Opposing the physiological classification would be the *pathological*, where, either by direct or indirect, by primary or secondary causes, physiological lesions develop in the mucous membrane of the upper respiratory tract and secondarily involve the ear. Again, another classification is the *constitutional* cause, where, from some condition of the circulation, some systemic condition involving the secretions, some systemic condition such as an infectious fever, some lesion of the heart, some lesion of the liver, intestinal tract, stomach, or, in fact, of any

\*Symposium paper presented at the Joint Meeting of the American Otolological Society of the American Laryngological Association.



of the internal viscera, in a secondary way through the circulation and through the irritation of the mucous membrane, may be a primary causal factor in ear lesions. So that the classification of these nasal, nasopharyngeal and pharyngeal causes would depend entirely upon the standpoint from which the practitioner or specialist views these conditions.

Let us enumerate some of the conditions of these structures that will come under the above classifications. The anatomical cause,—the narrow nasal orifice—or let it be an undeveloped orifice due to obstruction in the nasopharynx so frequently seen in children with adenoids, it may be a malformation, it may be an anatomical malformation not due to the narrow orifice, but due to the fact that there is a malformation involving the accessory cavities, in fact, the entire nasal structure,—such conditions would be important causal factors of aural diseases.

Irregularity in the size of the nostril is equally important. In fact, a wide open nostril or a nostril which admits of a large current of air, is equally as disastrous as a narrow nostril. The direction of the current of air owing to the shape of the anatomical nasal structure may be such that the current points directly toward the Eustachian orifice. In such individuals, ear lesions will certainly result.

The mouth-breather,—whether it is due to nasal or nasopharyngeal obstruction—if it is a nasal obstruction the removal of the same before any damage is done to the ear or the nasopharyngeal structure, may avert a resulting ear lesion. But the nasopharyngeal obstruction may be removed, and yet, on account of the bony development sufficient nasal capacity cannot be established and the individual remains a mouth-breather, setting up a constant irritation of the pharynx, thereby producing an inflamed condition of the nasopharyngeal structure and involving the Eustachian tube. These conditions come under several of the above classifications. The mucous membrane lining the nasal cavity may be overworked, due to irregularities in the size of the nostril. You may have the hyperplastic condition, causing nasal obstruction. The bone itself may be enlarged. These conditions, of course, would come under not only mechanical, but anatomical, pathological, or even physiological causes.

Traumatism is a mechanical cause, or even a pathological cause.

Atrophic rhinitis, with the shrinking of the mucous membrane, with the wide open nostril, with the formation of pus, with a certain amount of infection,—with the direct or indirect current of



air, or the current of air directed toward the Eustachian tube, certainly predispose to ear lesions. The violent blowing of the nose, forcing material into the Eustachian tube, causes primary or secondary, direct or indirect, infectious or noninfectious, mechanical—in fact, could be classed under almost any of the above varieties as to cause. Any form of rhinitis—the simple catarrhal form—would be either a primary or a secondary, a direct or an indirect cause. The postnasal inflammatory condition could be classed in exactly the same way. Take, for example, hay fever or any form of lithemic rhinitis, or the so-called rheumatic or gouty forms, where there is sudden congestion of the nasal mucous membrane, interfering with nasal breathing, and naturally an accumulation of mucus in the nasopharynx; these would be primary or secondary causes of the ear lesion, direct or indirect, infectious or noninfectious,—simply classified according to the individual case.

Take the specific lesions, tuberculosis, syphilis,—in fact, any of the specific granulomata, either from their primary infection or from a tertiary lesion, where the structure is actually involved,—such conditions may occur either as primary or secondary, direct or indirect, pathological, mechanical, in fact, would come under any classifications except physiological.

Under constitutional or systemic causes, take lesions of any of the viscera,—lungs, liver, spleen, kidney, stomach, intestinal tract.—such constitutional conditions as lithemia, rheumatism, gout,—while they are strictly classed under constitutional or systemic, they act as primary or secondary causes, direct or indirect, pathological and even mechanical, causal factors.

Age is a factor. Every observing practitioner or specialist knows that at puberty, in both male and female, there is turgescence of the mucous membrane of the nose. This is a mechanical cause and yet it is also a physiological one. There is no pathological condition of the mucous membrane; it is a purely physiological hyperemia; yet from the fact that it interferes with nasal breathing, it may become a primary or secondary, a direct or indirect cause of aural lesion. The same condition would exist at the menopause period. Also in the old, where there is a shrinkage of the mucous membrane, here again you would have a physiological cause, a mechanical cause, a pathological cause, and also a direct or indirect, a primary or secondary.

Children with the sensitive intestinal tract, with their tendency to diseases of childhood, would form another classification as to causes. Intestinal conditions such as constipation, intestinal worms,

diarrhoea, the infectious diseases of childhood, would all act as causal factors of nasal congestion, and the nasal congestion then would act as a causal factor of aural lesions. In fact, I think many of our pathological conditions of the ear start in childhood. One important feature in all these causal factors is this,—that if the cause of the nasal obstruction, no matter under what classification you may place it, is removed before there has been set up in the Eustachian tube or ear any permanent pathological change, then the removal of the cause will be curative; but if the causal factor remains sufficiently long to produce within the ear area a permanent pathological change, or in other words, a chronic condition, a change in the tissues, then we certainly will have a permanent ear lesion. This illustrates the primary and secondary condition. Take, for example, tumors of any form—the adenoid tissue, involving and blocking the Eustachian tube; nothing wrong originally with the Eustachian tube, nothing wrong with the ear, but through a mechanical obstruction, through a direct or indirect cause, through a primary or secondary lesion, the ear is involved.

Take the infectious diseases of childhood, or infectious diseases of adults. In all these diseases there is an associated inflammatory condition of the mucous membrane and the entire respiratory tract. Besides, there is added to this an infection, each disease, of course, having its own specific infection, but nevertheless exposing the aural cavity to secondary infection. To be sure, this may travel by continuity of tissue, and be a secondary involvement, or it may be a direct involvement owing to the violent blowing of the nose, forcing infectious material into the Eustachian tube. At the same time, there is a lowered physiological condition, a lowered resistance, and a greater tendency to spread of infection. Grippe, typhoid fever, pneumonia, either in children or in the adult, would also be a causal factor. Any infection, direct or indirect, primary or secondary, is an important etiological factor.

Foreign bodies, depending entirely on their size, location and position, would act in a number of ways, mechanical, pathological, primary, secondary,—in fact, in every way but a physiological one.

Occupation is a factor. Individuals confined in close quarters, poor ventilation, dust, various occupations which produce what is known as pneumoconiosis, dry atmosphere, overheated air, sleeping in rooms illy ventilated,—all causal factors indirectly to the ear through the irritation of the nasal mucous membrane and nasal obstruction to breathing, but primarily as far as the ear is concerned. In the case of boiler-makers, ironworkers and individuals employed

in shops where they are subjected to deafening sounds at all times, we have a slightly different condition. There is an internal primary cause on account of the irritation of the mucous membrane, due to the dust and constant change in temperature. Then, an external cause which does not come under the title of this paper, would be the effect on the ear drum when the individual is working in confined spaces and subjected to such deafening noises. Occupation as a cause is well illustrated in engineers, automobile drivers, balloonists,—any individual who is exposed to constant draughts and the necessary irritation produced by the rapid passage through the atmosphere.

Under amusements, I have seen children amusing themselves by blowing soap bubbles, forcing secretion into the ear, and setting up an acute ear condition. The violent blowing of the nose can also be classified under every known classification, even the physiological, because it is a physiological process.

Primary lesions of the eye, involving secondarily the nasal mucous membrane, and eventually the nasopharyngeal mucous membrane, may be causal factors of ear lesions. Sinus involvement, in which there is nothing wrong with the nasal cavity, but where infectious material is poured out into the nasal cavity, is also a causal factor.

Another physiological cause, or if I may be allowed to introduce another causal factor as to name, might be the aesthetic cause. This refers to the individual who labors under the impression that each morning he must give his nasal mucous membrane a bath, so he promptly snuffs up quantities of water through the nostril, thereby setting up a resulting inflammatory condition and originating a mechanical, a direct or indirect, a primary or secondary cause of aural lesion.

Sudden changes in temperature, or the temperature cause, is another factor. The sudden change from heat to cold, or from cold to heat, will produce irritation of the mucous membrane, which irritation may produce some ear lesion.

The cleft palate is also a causal factor. This might be an anatomical one, or a physiological one, or a mechanical one, but we have all seen cleft palates in which the Eustachian orifice was directly exposed and the necessary irritation produced by this exposure to the passage of food, and the irregular passage of air, produced early in life an ear lesion. I have under my care now such an individual who is stone deaf, and his deafness began at the age of five. The mucous membrane around the Eustachian orifice is so thick and fib-

rous that it is almost impossible to locate the orifice. This, as to cause, might come under almost any variety.

The enlarged and imbedded tonsil, let it be an adherent one or a congenital imbedded tonsil in which from its location it obstructs the Eustachian tube or forms a pocket back of the soft palate, keeping up a constant irritation, becomes an etiological factor in ear disease. The lateral pharyngitis, the simple tonsillitis, in fact, any infection or any primary lesion involving the pharynx or any of the pharyngeal structures, may become a causal factor.

Another causal factor which may be secondary as far as the nasal structures are concerned, is that nervous phenomenon which follows shock, grief, fright,—in fact, any condition which lowers the tone of the nervous system, in which we get the local cyanotic congestion. The engorgement of the nasal mucous membrane would be then a direct and indirect cause of aural lesions. There would also be the direct effect on the ear of the lowered nerve tone. In fact every otologist has seen the case of sudden deafness following shock and grief. While this does not strictly belong under nasal causes, at the same time, the congestion of the nasal mucous membrane is a direct factor.

Hereditary cause is another possible classification. So frequently we hear from our patients the statement that they inherited the catarrh, that they inherited the deafness, but if we look into the matter we find that they have inherited the family nose, the narrow orifice, the high nasal arch, with the long, narrow, slit nasal passage, where the slightest irritation will cause obstruction to the free passage of air, causing early in life a nasopharyngitis, and predisposing the individual to ear lesions.

It is very true, certain inflammatory conditions of the ear exist without any pre-existing nasal lesion, or at least, any lesion that is discernible at the time the aural lesion is discovered; nevertheless, in the large percent of acute aural diseases such nasal irregularity, either anatomical or pathological, exists.

The above causes bring us to this conclusion, that no matter what classification we may use as to cause, no matter what the obstruction may be, the first point for the practitioner to decide is this, first of all,—Can this nasal causal factor be removed, and if so, has this nasal causal factor already produced permanent pathological lesions in the ear, or will the removal of the nasal obstruction remedy the ear lesion?

1517 Walnut Street.

## THE SURGERY OF THE ESOPHAGUS, LARYNGOLOGICALLY CONSIDERED.\*

BY CHEVALIER JACKSON, M. D., PITTSBURG, PA.

Anterior and posterior transthoracic esophagotomy, dorsal mediastinotomy and other procedures for the resection of the thoracic esophagus, concern the laryngologist only in so far as he may with the esophagoscope render aid to the general surgeon or with the bronchoscope assist in passing oxygen to the lung to prevent pneumothorax.

Diseases of the esophagus may be classified into stenotic and nonstenotic, the stenotic being of spastic, cicatricial, compressive, neoplastic and acute inflammatory forms.

Surgery of the esophagus is chiefly of aid in the stenotic diseases associated with stricture and neoplasms. Diverticulum is a non-stenotic disease, but is usually caused by a subdiverticular stricture, through which the musculature of the esophagus endeavors to propel the esophageal contents. This pressure causes dilatation above the stricture. Another form of stricture is due to action, as by an adhesion, externally on a circumscribed portion of the esophageal wall. Therefore our subject narrows itself to the surgery of stricture, diverticula, and neoplasms.

The surgery of foreign bodies in the esophagus is not within the scope of the present symposium, but I wish to say that since the development of esophagoscopic methods external surgery has no place unless the foreign body has escaped through the esophageal wall. In which event it is no longer a case of foreign body in the esophagus. In all other cases, the foreign body no matter how large, if it has gone in by the natural passages, can be brought out by the same route. This is not a criticism of the past skillful work which had its place then, but has not now.

### PRELIMINARIES TO ESOPHAGEAL SURGERY.

Rest of the esophagus to reduce the esophagitis is an essential operative preliminary. Absolutely nothing but water, milk, ice cream, and consomme should be allowed, and bismuth subnitrate should be swallowed dry. If the patient is emaciated and feeble he should, when possible, be improved in condition before operation. No dependence should be placed upon rectal alimentation.

\*Read at the Annual Meeting of the American Laryngological Association, Boston, Mass., May 31, 1909.

Thirst can be quenched but starvation cannot be prevented by rectal feeding. It is better to have the patient gastrostomized early. The stomach should be empty of food, (it is never completely empty of secretions) and the bowels should be freely emptied by enema. I find a disposition in the profession to disregard this common pre-operative precaution, in patients who have been unable to swallow any food for several days.



Figure 1. Tent carrier attachment operated by the author's endoscopic forceps.

Before any operation upon the esophagus, it is imperative to use every precaution to exclude aneurysm, which often produces a compression stenosis simulating stricture. If the diagnosis can be made by radiography or fluoroscopy and physical methods, it is better not to pass an esophagoscope; for, while the careful and proper use of an esophagoscope passed without an obturator under ocular guidance, will in no way hasten the rupture of an aneurysm, the rupture

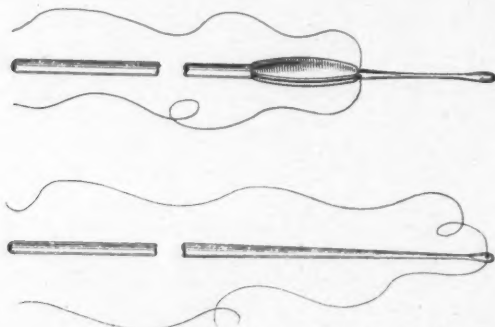


Figure 2. String-cutting esophagotome for esophagoscopic use.

when it ultimately does occur will be blamed upon the esophagoscope and thus unjust criticism will attach to a useful method. In such cases of aneurysm as cannot be otherwise excluded, the careful esophagoscopist will detect the lesion. The blind passage of an esophageal sound in an esophagoscopically unexplored gullet is a dangerous procedure rarely justifiable. Three deaths from its use have come to the writer's knowledge within a year. It is necessary also to exclude ulcerative and inflammatory disease, endo-muro,

—and peri-esophageal malignancy, and all forms of compression stenosis. It is necessary to bear in mind that the history of stricture from accident does not exclude malignancy, as evidenced in a case referred to the author by Dr. L. W. Swope. A stricture following the swallowing of lye afterward became the site of an epithelioma. (Specimen examined by Dr. Joseph H. Barach).

In another patient with stricture following the swallowing of lye, admitted to the Western Pennsylvania Hospital, in a dying condition, the imminent starvation demanded immediate gastrostomy which was rapidly done by Dr. J. Hartley Anderson. Esophagoscopy later by the writer showed a varicosity above the stricture which would have rendered string cutting or even dilatation ex-



Figure 3. Esophageal intubation tube. (a) Anti-deglutition swell. (b) Anti-regurgitation swell. (c) Thickened edge to prevent mucosal erosion.

tremely dangerous. Had the stricture been operated upon blindly as has been done in hospitals where there is no esophagoscopy practiced, serious and probably fatal hemorrhage would have occurred.

#### STRICTURE OF THE ESOPHAGUS.

Mechanical or operative treatment of strictures is indicated whenever the stenosis is either dilatogenic or sufficient to interfere seriously with nutrition. It is associated with little risk when done with discretion. Of course, it must be remembered that the esophagus is one of the most intolerant organs we have to deal with surgically. Shock is out of all proportion to the extent of the work, or of the lesion, as shown in ordinary acute esophagitis. Stricture of the esophagus has been in my experience, amenable to three methods of treatment.



- 1st. Bouginage per tubam.
- 2nd. Dilatation with esophagoscopically placed laminaria tents.
- 3rd. Esophagoscopic string-cutting dilatation.
- 4th. Abbe's retrograde string cutting method.

Bouginage is dangerous when practiced blindly with a sound. There have been numerous cases, a few recorded and many unrecorded, where fatal mediastinitis has resulted from the perforation of the esophageal wall weakened by malignancy, or the erosions that occasionally occur as the result of the acute or chronic esophagitis, which is always present above, never below, the stricture.

Bouginage per tubam is a very safe and often efficient procedure, when practiced with Bunts double olive bougies, which I have adapted to endoscopic work. The distance between the olives permits the following of the piloting olive on the tip by one on the stem large enough safely to do a valuable amount of dilating, the stem

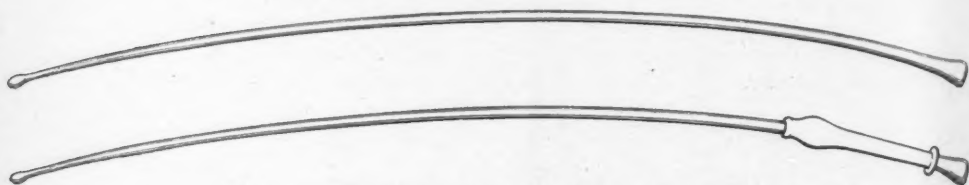


Figure 4. Flexible bougie for inserting esophageal intubation tube. The lower illustration shows the tube in position for the insertion of the bougie. After the point of bougie has passed the stricture the tube is run down upon the bougie, into position.

between the two serving as a guide to the second bulb. The first bougie is followed by a larger and a still larger one until the limit of safety has been reached. Nothing but the sense of resistance communicated to the finger will determine this limit.

Dilatation is repeated at the next seance two days later until sufficient dilatation has been obtained when, if the esophageal wall is free from weakness the ordinary soft flexible silk-and-wax bougie may be used and the patient trained to pass it himself, so that he may retain the dilatation obtained. This method is safe in careful hands and in properly selected cases. It yields good results in cases where the entire circumference of the esophagus is not cicatricial. In the class of cases where the entire circumference of the esophagus is involved in the stricture or strictures, the string cutting method of Abbe modified for esophagoscopic use is best, in my opinion. The original operation was done by an assistant holding the ends of a string as one would a gigli saw, one end com-

ing out the mouth the other out a gastrostomic opening. Traction to and fro is made with the string by the assistant, while the operator makes pressure upon the dilating bougie. Subsequently Abbe modified this for working from above only, by a string cutting esophagotome, the bight of the string being carried down by a dilating metal guide to the face of the stricture which is rapidly worn through by

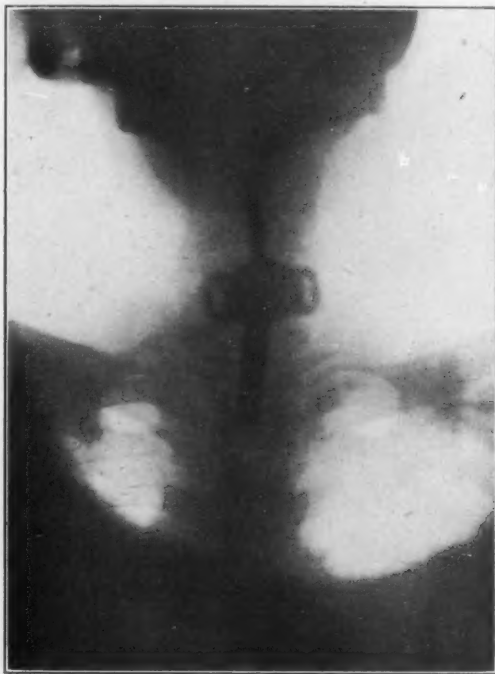


Figure 5. Esophageal intubation tube seen in position above and posterior to the tracheal canula. Cicatricial stenosis of the introitus esophagi in a man 60 years of age. Radiograph from the living patient by Dr. Russell H. Boggs.

the to and fro travel of the string worked by the assistant, while the operator makes prudent pressure upon the stem of the dilating esophagotome. In cases where the string-bearing end of the instrument could find the lumen of the stricture this method proved quite feasible in the hands of Dr. Abbe. But a very large percentage of the long standing cases have a dilatation or even a diverticulum above the stricture, and the lumen of the stricture is of pin-

hole size, so that it is impossible by blind groping to find the strictured passage or to be sure of it when found. It is here that the esophagoscope serves as a speculum enabling the surgeon to see what he is doing. The instrument that I have used, shown in Fig. 2, has the thread exposed on one side only. This side is turned toward the cicatricial side in strictures which do not occupy the entire circumference of the esophagus. The great danger of operating blindly is understood when we realize that the string saw-

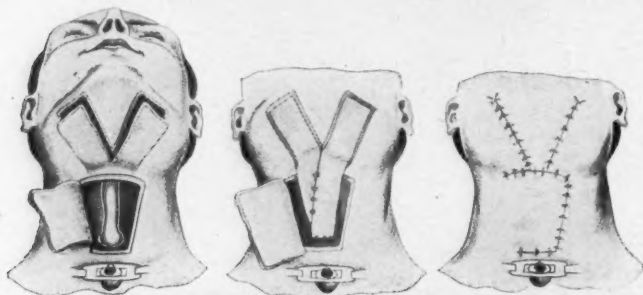


Figure 6. Autoplasmic repair of the anterior pharyngo-esophageal wall after resection for malignancy.

ing may be wearing away the normal esophageal wall in a partial stricture of this kind. As said before, most of these partial strictures will yield to bouginage.

**TENT DILATATION.** I have elsewhere described and I need here only show the instruments (Fig. 1) and state briefly that the tent is inserted through the esophagoscope. After five hours the tent is removed and the double olive bougies are passed thereafter about



Figure 7. Double olive bougie. Adapted by the author for endoscopic use. Originally used by Burt without the aid of vision.

thrice weekly for a few weeks. After that the patient is taught to pass upon himself the ordinary sound daily, if there are no contraindications.

**CERVICAL ESOPHAGOTOMY** for the removal of foreign bodies is, I think, rarely if ever justifiable in these days, for reasons already herein given. Cervical esophagotomy is of value as a step to esophagostomy and for the extirpation of malignancy. It is closely associated with laryngectomy, in which operation is very frequently

included a greater or lesser resection of the esophagus. In some instances malignant disease of the esophageal aspect of the laryngeal framework will be involved in the growth while the interior of the larynx is free from evidence of disease, unless there is a paralysis from recurrent involvement. Except in the latter instances the symptoms will be entirely deglutitory, yet the larynx in whole or in part will have to be removed on the general principle that the entire growth with an area of healthy tissue must be extirpated or any operation whatever is absolutely contra-indicated. In some cases of this kind, hemicricarytenoidectomy either lateral or post-



Figure 8. Photograph of patient six months after total laryngectomy, with resection of esophagus and pharynx for carcinoma. The lower opening is the tracheal orifice united to the skin. The upper opening is the esophageal opening ready for plastic closure. Patient could talk well by placing a colostomy pad over the two openings.

erior will be sufficient. If so, a portion of the larynx that will be useful for breathing, may be saved and thus the patient will have a whispered voice. But it must be remembered that any operation interfering with epiglottic closure, will almost certainly result in septic pneumonia, unless the entire larynx be removed and the trachea be brought forward and stitched to the skin.

Lateral cervical esophagotomy without opening the larynx is occasionally necessary for esophageal resection chiefly for malignan-

cy. It is rarely if ever the procedure of choice in stricture or for feeding. Its mortality is high.

SUBHYOID PHARYNGOTOMY gives access to the introitus esophagi, and subhyoid pharyngo-laryngotomy is useful where there is involvement of the upper posterior part of the larynx as well as the esophagus. In these procedures the rule above expressed in regard to epiglottic damage should be borne in mind. The slide speculum, the open speculum of Dickinson or Ingalls, the lateral speculum of Mosher all enable operation by natural passages, which is the method of choice for all benign diseases of the hypopharynx and mouth of the esophagus. In malignant disease their only use is to facilitate the taking of a specimen.



Figure 9. Photograph of a child, 20 months old, a victim of esophageal stricture. It is in the act of inducing vomiting by the insertion of its fingers to the fauces, a self-discovered means of relief. Referred by Dr. F. LeMoynes Hupp.

ESOPHAGEAL INTUBATION. In three cases, one of stricture and two of inoperable malignancy. I have inserted a tube (Fig. 3) into the stenosed lumen and enabled the patient to swallow liquids and raw and soft boiled eggs. The strictured case should more properly be called an impermeable esophagus from luetic sloughing and ulceration. The slide speculum enabled me to make an opening through the cicatricial web into the esophagus, the opening being maintained by the tube shown in Fig. 3. In this instance replacement of the tube was done every second day, by the aid of the slide speculum. In one of the cases of malignant disease the tube was introduced by means of the flexible bougie shown in Fig. 4, which was first passed and then the tube run down upon it. This I consider safe in the cervical portion of the esophagus. The tube

is shown in position in the radiograph Fig 5, taken by Dr. Russel H. Boggs from the living patient. In the other case of malignancy the growth was in the thoracic esophagus and the tube was placed through the esophagoscope.

**AUTOPLASTIC REPAIR OF THE ESOPHAGUS.** Esophageal resections of limited extent are reparable by approximation of the edges. Those of greater extent will be followed by stricture if indeed there be not failure of union from sloughing out of the sutures. The general plan in these cases of larger deficiencies is to turn the epidermal surface of one of the flaps inward to serve as mucosa. This



Figure 10. Photograph of a man 70 years of age, taken one year after total laryngectomy, with resection of the upper 5 c. m. of the esophagus for endothelioma originating in the larynx.

lessens cicatricial contraction. In all these operations, of course, care must be taken to avoid turning in hair-bearing epidermis. The most frequent reparable post operative esophageal deficiency is that associated with laryngectomy for malignancy of the anterior esophageal wall, either primary or secondary to extrinsic laryngeal malignant extension. It is often associated with a deficiency of the pharynx also. In this class of cases good results follow the plastic operation by submental flaps (Fig. 6) which is readily understood from the illustration. The epidermal surface of the submental flaps is turned inward and the flaps are sutured in place after which the fresh surface of the flaps is covered and the entire

wound closed by the large cervical flap. A little wick of gauze drainage may be inserted if thought necessary, but is better omitted if possible. The epidermal surface in a sense takes on the duties of a mucous membrane, acquires a slippery surface, and deglutition is usually good.

#### CONCLUSIONS.

1. In no case of dysphagia should any esophageal procedure precede esophagoscopy.

2. In every instance every means to exclude aneurysm should be employed prior to esophagoscopy.

3. Esophagoscopic examination should be used to exclude neoplastic, spastic, compressive and inflammatory stenoses, as well as ulceration and varicosities.

4. External esophagotomy for foreign bodies is rarely if ever justifiable.

5. The treatment of strictures is best carried out by three procedures:

(a) Bouginage per tubam, using a double olive bougie passed by sight through the esophagoscope.

(b) Dilatation by an esophagoscopically placed laminaria tent.

(c) Esophagoscopic string-cutting dilatation.

(d) Prolonged intubation.

(e) Abbe's retrograde string cutting method.

(f) Resection of the upper portion of the esophagus, if it interfere with glottic closure, is so certain to be followed by septic pneumonia that it is safer to close off the larynx, or to extirpate it and bring the trachea forward and stitch to the skin.

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### THREE ESOPHAGEAL CASES.\*

BY HARRIS PEYTON MOSHER, M. D., BOSTON.

I wish to present three cases, two cases of stricture of the esophagus with dilation and one case of diverticulum. Then I wish to discuss briefly the treatment of strictures and in so doing to dwell somewhat on instruments and instrumentation and to demonstrate on preparations and models the major facts of the applied anatomy of the esophagus.

Case 1. A boy two years old drank a caustic solution and three months later developed marked difficulty in swallowing. Milk became his only food. One day a part of the milk which he took would stay down, the next day the greater part would be regurgitated soon after it was swallowed.

Under ether a stricture was found at the cardiac end of the esophagus and a moderate dilatation above it. The stricture proved to be about an inch long. It dilated readily with soft bougies to 20 F. From this point the dilatation was carried to 32 F. with the mechanical dilator. It was impossible to pass even a small bougie into the boy's stomach before etherization, but afterwards a number 32 bougie could be passed readily. Since the dilatation which occurred about a year ago the 32 F. bougie has been passed once a week by the family physician. To-day the boy is as well nourished and rosy as one could wish. He still has trouble in swallowing meat.

Case 2. Through the kindness of Dr. Horace D. Arnold and Dr. R. C. Larrabee about two months ago a young woman of thirty, was referred to me for difficulty in swallowing of fifteen years duration. She gave a rather doubtful history of having swallowed a fish bone during her childhood.

At the time of this accident the father pushed his finger down the child's throat and was supposed to have removed the bone. During the past fifteen years the patient has had numerous consultations with physicians and at least once during this time has had bougies passed at regular intervals for a month, and has been fed by stomach tube for an equal period. The chief symptom always has been regurgitation of food within an hour after it was taken. Associated with this was great evidence of malnutrition. The normal weight of the patient is 130 pounds. When I saw her she

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weighed 75 pounds, and was fast becoming a walking skeleton. There never has been any pain, only a sensation of fullness after eating, the feeling of fullness and distention starting in the epigastrium and extending into the neck as far as the larynx. The regurgitation of food was associated with no nausea and seemed to be in a great measure under the patient's control. Whenever she felt discomfort and wished to do so she could bring up the food she had taken. As Dr. Arnold put it, "On request she would bow politely and present you with her last meal." The essential points in the physical examination were as follows: The patient was much emaciated. Over the full width and the entire length of the sternum there was a tympanitic area. No stomach tympany could be made out. A test meal was returned undigested.

I have never had the pleasure of working for a more willing or a braver patient. She submitted without a murmur to a two hour fluoroscopic examination, during which she was fed bismuth and finally had an X-ray plate taken. The conclusions drawn from these two methods of examination were that there was a stricture at the cardiac end of the esophagus with an elongated dilatation of the esophagus above it. The dilatation swung to the right of the median line so that the tip of a bougie struck the bottom of the dilatation but did not enter the stomach.

*The Ether Examination.* Under ether, the esophagus was easily entered with a large oval tube. The lumen of the esophagus was found to be dilated all the way down, the dilatation increasing and reaching its maximum at the lower part behind the heart. (There were no scars). Everywhere the esophagus appeared to be normal. The posterior wall of the heart could be seen for its full length pulsating strongly into the dilated esophagus from the front and from the left. The opening into the stomach was found readily. It lay to the extreme left of the bottom of the pouch and on a somewhat higher level. When the esophagus was ballooned the dilatation appeared as a large black cavern which the light of the tube failed to illuminate. The opening into the stomach readily took a good sized bougie. The bougie was followed by the mechanical dilator and the opening spread to 45 F. before the resistance became marked. At this point the dilatation was discontinued and a small metal bullet was wound with flax thread and carried with forceps into the stomach and left there. The upper end of the thread was brought out of the patient's mouth and fixed to the cheek with adhesive plaster.

*The After Treatment.* The after treatment was as simple and as satisfactory as the examination. For twenty-four hours the patient was nourished by rectum, then small quantities of milk were allowed by mouth. The greater part of this was retained. All that was given and all that was returned were measured and compared. A food chart showed the nutritive value of the food taken so that we had the satisfaction of knowing accurately at any given moment how much the patient really took and how nearly this amount approximated the normal amount of food reckoned in calories which this patient's normal weight called for. Needless to say this scientific sureness of feeding was not due to me but was the result of work previously done in this line by Dr. Arnold. It was throughout a great comfort to me. I had the feeling which a surgical man seldom has now-a-days, that the medical part of my case was thoroughly up-to-date and scientific.

On the second day the olive bougies were passed on the thread, starting with the small one and then using the two largest. All the bougies passed easily. After the third and fourth day the patient ceased to regurgitate and at the end of a week was gaining weight. At ten days the patient was eating everything, her meat being minced. She no longer had the feeling of fullness after eating. She was conscious at times that food entered the stomach slowly but the former distress did not come back.

I saw the patient about ten days ago. She is putting on weight all the time, and now weighs ninety pounds instead of seventy-five, her weight when she entered the hospital.

I will speak of the third case and then give what I have to say on the treatment of the three cases.

Case 3. A woman of middle age was sent to me because she had had for a few years symptoms suggesting a pouch and because the attempt to pass a stomach tube, which was necessary on account of a fermentative condition, had failed at the last attempt, although it had passed easily at a number of previous trials. The tube seemed to halt just below the cricoid cartilage. The patient was examined under ether. The object of the examination being, of course, to find out whether or not there was a diverticulum, but especially to determine the presence or the absence of beginning cancer.

*The Ether Examination.* The large oval tube halted about an inch and a half below the cricoid cartilage, and no lumen could be seen ahead. A tube the size of the gastroscope passed readily into the stomach. The esophagus was apparently normal. Remember-

ing how easy it is to miss pathology with the small tube I went back to the large oval one. Again the tube halted in a blind pocket about an inch and a half below the cricoid cartilage. At this point the window plug was put in place and the lumen of the esophagus dilated. At once it was seen that the end of the tube was in a pouch. With each contraction of the hand bulb which controlled the air pressure the walls of the pouch expanded so that the whole of the pouch could be distinctly seen. On withdrawing the tube slowly, and at the same time forcing air into the esophagus, at a point about an inch below the level of the cricoid cartilage, suddenly two openings were seen. Both openings dilated with each pressure on the bulb. One opening was in the lower left quadrant of the field of vision and the other in the upper right hand quadrant. A probe passed into the lower opening entered a pouch about three quarters of an inch long and a bougie passed into the upper one slipped easily into the stomach. Once the openings were found it was easy to pass the end of the large oval tube at will into either, to go to the bottom of the pouch or to go into the stomach. Before the esophagus was ballooned, however, the large tube missed the opening of the esophagus and the small tube missed the opening of the pouch. Both openings were found only after the esophagus was distended with air. In this case, therefore, the practice of ballooning the esophagus demonstrated its usefulness and its possibilities.

*Instrumentation and Methods of Examination.* In a paper soon to be published I have gone at some length into the methods of making esophageal examinations, so that I will refer at this time, only to a few points which I wish to bring before you because some of them I am convinced will be of service. It is a great convenience in esophageal examinations to have the examining table placed upon a platform while the examiner stands on the floor. In this way the old sprawling method of conducting the examination is done away with and the procedure assumes a more surgical aspect. Whatever instrument is used, occasionally strong pressure is put upon the teeth. This is especially true if the operator uses the open speculum. Indeed, for a time I exposed myself to the good natured ridicule of my associates at the hospital by loosening and occasionally extracting teeth. Now I use in all cases, a thin dental impression tray and the teeth, good or bad give me no farther trouble. In my opinion it is essential to use as large a tube as the esophagus under examination can be made to take. The lateral po-

sition, the dental tray and the open speculum make it possible to start the introduction of very large tubes and such tubes once beyond the obstacle offered by the cricoid cartilage proceed downward with ease.

The lumen of the esophagus is very much larger than we are accustomed to think it is, both in the infant and in the adult. At one year the esophagus will pass a flat mother of pearl button one inch in diameter. Between two and three years of age the upper part of the esophagus will easily take the end of the Jackson tube spatula. In the adult the general surgeons have for years passed bougies in old stricture cases where the stricture has been dilated and is being kept at its maximum dilatation, which are at least an inch in both diameters. It is repeatedly stated that three quarters of an inch is the safe limit for dilatation in stricture cases. This measurement is manifestly too small.

The objection usually made to the use of large tubes in the esophagus is that they cannot be used without ether. To me this is not an objection. It is only the exceptional case which I wish to examine without ether. A negative examination under cocaine with a small tube amounts to nothing. Whereas a negative examination under ether with large tubes affords data upon which some reliance can be placed.

I consider it settled that strictures of the esophagus are best diagnosed and best treated by means of the esophagoscope and instruments used through it. Nothing could be more satisfactory than the finding of a stricture by this means, and determining its location, nature and extent. Opening the stomach for the relief of non-malignant strictures ought to become a rare operation. Opening the esophagus from the side of the neck for the removal of smooth foreign bodies is already obsolete surgery. The ballooning of the esophagus promises to be a help in locating the lumen of tight strictures, and the direct method of carrying a gelatine capsule filled with thread through the stricture into the stomach is much better than feeding the thread to the patient. The perforated metal olive bougies of Mixter which run down a thread as a guide are of great service in pouch cases and in cases of tortuous or tight strictures. The thread keeps the bougie from going wrong. After a while the small guide can be used without the thread and the olives passed on the guide. The small metal guide often finds the way better than the larger elastic bougie. When the metal guide is in place the large olives can be run down on it with the greatest confidence.

All strictures cannot be dilated. Some will need to be cut. This is now being done. The instruments for accomplishing this are much the same as those used in the urethra. Certain strictures are ideal for the treatment by cutting. I remember one case which I saw with Dr. Coolidge. The patient was a child. In this case there were three or four falciform folds partially encircling the lumen of the esophagus at different levels. The folds gradually became smaller until the main stricture was reached. These partial strictures could be readily slit outward to the esophageal wall. When there is a firm ring-like stricture, cutting still can be done, but, of course, it must be employed with the greatest caution. There are too many major relationships about the esophagus to permit the slightest slip up in this matter of cutting the stricture. The esophageal wall must never be cut through. Look at these specimens for a moment and see for yourselves. For perhaps two inches in the upper part of the esophagus it is safe to cut backward and risk perforating the esophageal wall. Everywhere else the esophagus is surrounded with the most important structures. Take the relationships in order. From behind there are the thoracic branches of the aorta, the thoracic duct, the azygos vein, and the descending aorta. Anteriorly, first the posterior membranous wall of the trachea, then the arch of the aorta, then the heart itself. On the right side, in the neck, the recurrent laryngeal nerve, then the right innominate vein, the right azygos vein, and finally the inferior vena cava. On the left side, again in the neck, the recurrent laryngeal nerve in the thorax, the arch of the aorta once more, and finally the whole of the thoracic course of the descending aorta. This is surely a discouraging outlook for cutting. The case is not hopeless, however, because, although it may not be anatomically permissible to cut through the walls of the esophagus on any side, the clinical fact remains that in the majority of cases so much cutting is probably not necessary. We can cut the stricture and nothing else. And this we shall learn to do. I believe that the cases are few where it will again be necessary to open the stomach and saw through the stricture with a string. This method has done good service, but we now have a better one.

What are the lessons which these three cases teach? The first case illustrates the most modern and so far the best treatment for strictures of the esophagus. The stricture was found with the tube and dilated through the tube. This case needs to be dilated again. Perhaps the stricture may come to cutting.



The third case, to take the last case next and out of order, was a pretty example of the help which ballooning the lumen of the esophagus affords in finding a diverticulum. This procedure should be resorted to whenever the lumen of the esophagus does not stand out clearly ahead of the advancing tube.

The second case is the most recent, and the one which still in a measure surprises me. Here was a history of trouble with swallowing for fifteen years. For one month during this time bougies were passed and for an equal period the patient was fed by the stomach tube. The fluoroscope and the X-ray taken after bismuth was swallowed showed a marked dilatation of the esophagus, the dilatation being especially prominent in the lower part, near the opening into the stomach. From the X-ray it seemed probable that the opening into the stomach from the pouch-like dilatation was to be found on the left. I expected a hard examination and a long after treatment. All my expectations, happily, were disappointed. The examination was most easy, the dilatation pouch was readily made out, and the opening from it into the stomach was found at once and proved to be easily dilatable. Within a week, with daily passing of the metal olives, all regurgitation stopped; in a week and a half the patient was eating practically everything and eating it in the natural way, with the exception that the meat was minced. It is now about two months since the examination, and the patient eats everything, only taking the precaution in chewing her food to out-Fletcher Fletcher. Meat she feels goes into the stomach slowly, but a swallow of fluid at once sends it along. The esophagus which was stretched for fifteen years has retained its elasticity sufficiently to contract. This was a surprise to me. In fact the whole case from the beginning to the end has surprised me from its extreme ease and simplicity. If such cases can be duplicated, and I believe that they can, a certain number of esophageal cases which hitherto, have been sent from pillar to post, which one day have been put down as due to nervousness, and the next, subjected to repeated attempts at the blind passing of bougies, and all the time have remained half starved, will be relieved as other surgical cases are now relieved, in a reasonable time by direct examination and by direct treatment.

At the risk of making an anti-climax, I cannot refrain from mentioning two other happenings in this case. One was somewhat ludicrous, the other anything but amusing. I will take the disagreeable happening first. I saw the patient last, one week ago. Since

she has been out of the hospital, perhaps a little over two weeks, her family physician has been passing the metal olives on the metal guide. The last two or three times the olives were passed, they stuck behind the larynx on the return so that the physician told the patient that he thought there was narrowing in this place. The stricture at the cardiac opening gave no trouble either to the passage or to the return of the olives. I found on passing the olives that there was no resistance anywhere on going down but when the olives reached the region of the larynx they stuck firmly. After trying a few times and failing completely to get the olives up, I used almost enough force to lift the patient from the chair, but still the bougie failed to come. He was caught like a fish on a hook. I had visions of giving him ether in order to release the olives. Just as I was beginning to get a little excited, I thought of the probable explanation of the trouble. The olives were caught below the larynx and were tipping it out of line. As soon as I thought of this I pushed the larynx downward and forward with my finger in the mouth and up came the olives. Needless to say I shall not soon forget this maneuver.

This happening distressed both the patient and me. The other happening distressed only the patient. The day before she left the hospital, she asked like a true New Englander, if she could eat beans when she went home. She said her mother told her she couldn't and asked for my decision in the matter. I told her that she could and she did. Her stomach had not been used to beans in quantity for fifteen years and they true to their usual custom liberated a great quantity of gas so that she became acutely distended. She tried to get the beans up but failed. Had they been in the esophagus she could have accomplished this easily by her old habit of regurgitation. Now, however, she could not get them again as she had lost the power to vomit. For an hour or two, therefore, she prayed to go back to the old order of things, until finally the distressing meal passed onward.

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**SPACE AND TIME AS AURAL CONCEPTS: A REVIEW OF  
v. CYON'S THEORY OF THE LABYRINTH.**

BY PERCY FRIDENBERG, M. D., NEW YORK.

The clinical tests of labyrinthine function, as expressed in equilibration and its oculo-motor reactions, notably nystagmus, which have been systematized and applied to the practical needs of otology by the painstaking work of Barany, v. Stein, Koranyi, and others, are based on the assumption of fundamental correctness of the theory of Breuer-Mach and Crum Brown. This hydro-dynamic or hydro-kinetic hypothesis assumes a current, or in its modified form, a stress of endolymph in the semi-circular canal system and that of the vestibule, which is set in action, respectively, by rotational motion and by gravity. The resultant stimulation of the nerve terminals in the ampullae and in the acoustic cristae is sensed as a turning movement in the plane of the stimulated canal, or on the other hand, as an inclination to the vertical, laterally or antero-posteriorly. While the physiological adequate stimulus is, accordingly, a turning movement of the canal, this may be replaced, clinically or pathologically, by various forms of irritation, mechanical, caloric, or electric, with uniform results as to subjective reaction in sensation of motion and in the compensatory reflexes of the eye-muscles as well as those of the head and trunk. These motions, reduced to their simplest terms, indicate an attempt to regain the lost or altered position by a reversal of the sensed rotation, to fix the apparently moving visual field and to correct deviation from the vertical by torsion movements of the eye and by appropriate body movements. Clinically, this may be expressed by the formula that nystagmus takes place in the plane of and toward the irritated canal, corresponding to a displacement of the entire visual field in a direction contrary to the sensation of subjective turning, that it is increased by looking in the direction of the irritated or diseased canal, i. e., toward the apparent source of moving objects, and that the head—and body—turning have a similar fixational as well as a more obvious equilibrational or steadying purpose. The apparent discrepancy in the caloric test as usually applied, is easily explained by the fact that cold water acts as a depressant, not as an irritant, and the direction of both reactions is reversed.

If hot water is used, which is inadvisable for purely practical reasons, the results are perfectly congruous. In galvanic stimulation, it is to be remembered that the stimulating action takes place at the cathode, and if this be borne in mind, the interpretation of the test data offers no difficulty. These data with those gained by the characteristic anomalies of static and dynamic equilibrium as expressed in disturbances of balance and of gait are adding greatly to our knowledge of the symptomatology of labyrinthine disease and may with some confidence be expected to supply a uniform and scientific basis for clinical diagnosis. We may say that the Breuer-Mach theory has proven itself to be a good and sufficient working hypothesis for practical use. This theory has many supporters and one pre-eminent antagonist, v. Cyon, a physiologist of repute and experience, who for many years has made a study of labyrinthine function, devoting an immense amount of time and labor to animal experiment, clinical investigation, and to the careful analysis and criticism of the varied data on which the equilibrational theories of the labyrinth have been based by Goltz, Ewald, Breuer, and others. v. Cyon raises objections not only to the validity of the animal experiments on which the hydro-dynamic theory is based, but also to the physiological reasoning and the teleological interpretation of its supporters. Among the most striking objections we note the following: The semi-circular canals are not anatomically constructed so as to offer a suitable mechanical basis for mediating rotational stress. Such a stress, if momentary, could not explain continued sensation of turning, and if persistent, would afford to consciousness no means of distinguishig between a continuing rotation and a momentary one. Animals with artificially injured or physiologically defective canals such as the waltzing mice of Japan, lampreys, and deaf-mutes, show no disturbances of equilibrium, while they do show very striking disturbance of recognition of direction and, consequently, of orientation.

Destruction of the labyrinth does not lower tonus of the muscles, as postulated by Ewald, but, on the contrary, increases it, by removing the natural inhibitory action, which, according to v. Cyon, is one of the most important functions of the semi-circular canals. The disturbances of equilibrium, noted by Ewald and his school, are spastic, not parietic. A special sense for rotational motion is physiologically unnecessary and practically absurd, as rotation is merely continued progression in an exclusive direction, right or left.

The semi-circular canals may be cut through, emptied of endolymph, or even allowed to dry out completely without destroying balance or the sense of rotation.

The alterations of sensation of the vertical, explained by Breuer and Mach as ocular compensation for a sensed change in the static labyrinth (maculae), as in motion around a curve, are purely errors of visual judgment, and due to actual inclination to the vertical, as on curves, either the vehicle (railway car, bicycle), or the individual inclines toward the center of the arc to prevent being thrown off the track by centrifugal force. Balance is a composite, and depends not only on acoustic, i. e., labyrinthine factors, but on visual, tactile, muscular, and tonic sensations, as well.

Having summed up his objections to the basic details of the hydro-dynamic hypothesis, v. Cyon proceeds to develop his own theory which brings the elements of tone and sound perception into relation with the innervational control and regulation, both as to intensity, succession, and duration, of the entire muscular apparatus of the body, especially of the eye; with the rhythmic co-ordination of speech, and with the psychic control of function. This co-ordination depends on concepts of number which can only originate in the cochlea, and is associated with concepts of direction, dependent physiologically on stimulation, continuous or intermittent, of the semi-circular canals. These concepts form the basis for all our ideas of space, actual as well as ideal, and explain on a basis of rational empiricism, the various axioms of all the mathematical sciences, the operations of arithmetic and algebra, as well as the formulae and theorems of Euclidean geometry. The abstraction of ideal time, too, is based on concepts of number associated with direction, and the former alone, capable as it is of continuous extension, explains our conception of infinity which we apply to duration (time) and to direction (space). The tactile field is obviously, and the visual field, actually, limited; the field of audition, direction, and number, alone, is unlimited.

It may be well to say in passing that there are two views of our consciousness of space. According to one, this sense is aprioristic, instinctive, inherited as such, without a sensory basis, and comes into the world with us in such a way that as soon as we are able to distinguish objects at all and to form visual concepts we necessarily attach to them the function of existing in an abstract medium, of being separated by more or less definite extents of the same medium, which is nothing else than space. The second theory,

the heuristic, considers the sense of space as an abstraction, more or less unconscious, acquired by experience and representing the sum total of all our personal, or possibly also our inherited sensory impressions of matter, form and mass. According to this formula, space is a summation, by the mind, of all the possible matter concepts of which it is conscious as an objective whole which is then placed in opposition, rationally, to the sum of the non-material bordering, defining and separating the first, and this again, is nothing more nor less than space. A similar duality of logical consideration or ratiocination has been applied to time, which in the first case is considered as a special form of sensory concept, peculiar to man, and inherited as a more or less specialized and perfected point of view or way of thinking, while in a heuristic sense it is an abstraction from the sum total of all thoughts or thought-substance of which we are conscious, as the medium non-thought in which these mental products exist and by which again they are bordered, defined, and separated. As matter is made continuous by space, so thought is made continuous by time. Coming now to functions which are more evidently connected with anatomical structures of the ear, such as equilibration, direction, and sense of position, we have again a fundamental antagonism among physiologists and metaphysicians as to the nature of the mental process involved. For the one group, these sensations or complex of impressions which we call balance, for instance, is nothing but the total of all muscle, touch, sight, and equilibration stimuli, while for the others it is a supernatant something, more than the sum of all its parts and incapable, with our present knowledge of psycho-physiology, of accurate analysis. (Even consciousness itself, in like manner, is considered by some as a special as yet unlocalized psychic function while others view it merely as the sum of all sensory impressions and of the past as well as present associations).

Phylogenetically the equilibrational function of the inner ear is the older, as it is the more important for the integrity of the organism. This is shown by the presence in lower animals of the static labyrinth only, in the form of a specialized and differentiated focus of the touch sense. In children we find a lack of balance which does not depend in any way on muscular weakness, combined with slight tendency to dizziness or vertigo, suggesting an undeveloped function and only rudimentary reaction to disturbances of it.

With physical and psychical growth and development and exercise of all the sense organs, our balance becomes more accurate



and delicate, our reaction to disturbances correspondingly more sensitive. The feelings connected with our sensations of position, direction, and motion, as well as our conscious notions about them are made up of impressions of vision and eye-motion, touch, and muscle sense, together with the labyrinthine sensations which have developed synchronously and in correlation with them. The sense of space similarly develops from our sense perceptions of objects which are recognized by their inaccessibility to the touch as belonging to the external world of the non-ego. These impressions of objective space are not formed by one sense, but by all, and it is in keeping with the dignity and importance, this function for life that one of the organs mediating it may be destroyed without completely abolishing and in some cases without markedly disturbing the total functions. Thus, total congenital blindness, labyrinthine deafness as in deaf mutes, or widespread anaesthesia of the skin does not destroy our sense of position or our balance, but slight anomalies of any one of these organs may modify the sum of impressions which we have decided to call equilibrium. This might be considered in terms of Meltzer's theory as a functional "factor of safety" in the human economy. We can now understand how dizziness or vertigo can be caused by ocular, aural, or cerebral lesions. We also recognize the futility of holding any one symptom or phenomenon, as nystagmus, responsible for the causation of the disturbance which it accompanies. There are vertigo forms without nystagmus as there are nystagmus forms without vertigo. Similarly there are forms of vertigo without the slightest body motion or other adequate stimulation of the labyrinthine end-organs, such as that produced by confusion of visual images by swinging mirrors or prisms, cylindrical lenses, and so on. Nagel has shown that there is a continuous series of dizziness-forms from the purely visual at one end, through motion to the purely labyrinthine, at the other, each attended, naturally, by reactions and disturbances in the parent organ. Disregard of this condition has led to a one-sided interpretation of certain striking symptoms to the exclusion of others and the promotion of such a symptom factor as nystagmus, for instance, to the dignity of a cause of vertigo.

v. Cyon accepts the empiristic theory of ideal space, which he says, can no longer be considered as an inborn native expression of our conceptual faculties, but must be considered, like our ideas of color, musical sounds, and so on, as a product of thought which we owe to a special form of sensation connected with a peripheral sensory organ. In this way we can understand how just three di-

mensions of space form the basis of our geometrical ideas, and geometrical axioms appear to us as the necessary fixed limits of our senses. In a word, ideal space in three dimensions, depending on sensations originating in the three semi-circular canals also serves by the aid of tactile sensations to determine the position of external objects.

v. Cyon picks out many facts in regard to visual, tactile, auditory, and muscular sensations as a basis for the sense of space, direction, and time, rearranging them in accordance with his system to lead, like all roads to Rome, i. e., the tri-dimensional system of the semi-circular canals. In regard to this interpretation, the writer would again call attention, as in a previous communication, to the necessity of considering consciousness as a whole as well as in its special manifestations as a product of the sum of our sensory conceptions rather than as a result of this or that functional factor. Balance, motor and sensory reaction, concepts of time and space, of external and subjective motion, whether translational, rotational, or positional, distance, and direction, as well as the sum of our motor and sensory reaction depend on the co-operation and co-ordination of all our perceptive faculties. Similarly details of physiologically or pathologically altered function such as nystagmus, dizziness, vertigo, loss of balance, movement, reactions of the head, eyes, and extremities, fixation-anomalies, and many others, are most satisfactorily interpreted, even if not completely explained, by the normality or abnormality of the whole psycho-physiological apparatus of the human brain. The most extreme disturbances of vision alone, of body position alone, of audition alone, or of tactile sense alone, may fail to cause confusion in our sense of direction, balance, and space. It is only when there is real or apparent incompatibility or lack of correspondence and harmony of one set of concepts with those from another sensory organ that confusion, subjective or objective results, which we term respectively dizziness and loss of balance.

To deny, as v. Cyon does, that rotation and gravity have a direct action on the ampullae as well as on the cristae, seems to deprive his own theory of a valuable support. Neither rotation nor gravity are connected with acoustic stimulation or auditory impressions of any sort, and if they are to be excluded, as from this point of view they must be, from participation in the normal and physiological excitation of the semicircular canals, the function of the latter, whether we take this to be balance or perception of direction

and time, must be independent of the most constant and far-reaching mechanical factor, not excepting light and heat, of which the human mind has any knowledge.

The writer's view of v. Cyon's broad and elaborate theory\* has been necessarily cursory and general, dealing as it does with views which fill a volume of over four hundred closely printed quarto pages with the most varied and detailed data and reasoning, a wealth of facts supplied by animal experimentation of the most scientific and delicate nature, clinical observation and nature study on the one hand, and the most ingenious and keen analysis of current theories, on the other. Many of v. Cyon's data are supported by early investigations, notably those of Flourens, Autenrieth, Venturi, Weber, Helmholtz, Hering, Delage, and even of Breuer and Mach, whose hypotheses he attacks. A thorough understanding of this author's views is rendered extremely difficult by the very scope of his view, and by the possibility of a multitude of psychological interpretations for many an apparently simple physiological observation. This breadth again is one of the weaknesses, or at least so it appears to me, of v. Cyon's views, and one gets the impression that he has constructed a stupendous and almost immeasurable edifice on a small foundation, which could better serve a simpler and more definite purpose. V. Cyon's generalizations are logical and plausible. It is only as we approach his underlying physiological fundamental theory of labyrinthine mechanism that we feel a vagueness and lack of supporting facts which are fatal to a working hypothesis, and contrast sharply and unfavorably with the definite and clean-cut explanations of the simplest as well as the complex phenomena which are given us by the theory of Breuer, Mach and Crum Brown. This is especially noticeable in his failure to give a clear and satisfactory account of the normal method of functioning and of the adequate stimuli of his hypothetical organ of tri-dimensional space perceptions. His dialectics on the contrary are wonderfully keen, and certain objections to the Breuer-Mach theory, which have been considered above, notably in regard to every-day experiences of balance and perceptions of the vertical have not as yet been successfully traversed. v. Cyon supports his views, as I have just stated, by numerous well authenticated obser-

\*Note.—Nagel, who has given us perhaps the most clear and detailed account of the present theories of labyrinthine function and an analysis of the visual, auditory, and combined views of the equilibrational function, admits that he does not understand the theory of v. Cyon, so that the writer is estopped by weight of authority from laying claim to any but a most general and insufficient comprehension.

ventions in the field of physiology of vision and other senses (Helmholtz, Delage-Aubert), and combines these admitted facts so deftly and cunningly that we cannot point out the underlying error if there be one. For the practical purposes of our science and particularly of pathology, however, we may safely state that he has evolved an interesting system of philosophy or rather of physiological psychology, rather than a working hypothesis of labyrinthine function and mechanism.

The weak point of v. Cyon's theory, as already stated, is the lack of a satisfactory histological basis for his hypothetical endorgans in the semicircular canals, and the consequent failure to describe, in anything but the vaguest terms, the physiological adequate stimulus by which the supposed function is brought into play. This is just the strong point of the hydro-dynamic and hydro-kinetic theories, which give a clearly defined basis for interpretation and psychological abstraction. It is the latter which v. Cyon attacks most successfully, and the interpretation and psychological application of the experimental and biological facts according to his theory of the labyrinth as a sensory organ for sensations of direction and number, and indirectly for the production of concepts of time and space, appeals to us as much more logical and theoretically necessary than the assumption of a perceptive mechanism for rotation, alone. v. Cyon's analysis of the latter theories reveals a number of inaccuracies and discrepancies; the majority of his objections, however, deal with metaphysical interpretations, and can be easily met. His own theory is open to the fatal exception that it has no actual foundation in fact and that the postulated stimulation of the semicircular canals by sound vibrations has never been demonstrated. From a theoretical point of view we might add that such stimulation being necessarily interrupted, discontinuous, and in most cases infrequent, as well as quantitatively negligible, almost, in comparison to the multitudinous sense percepts gained by vision, touch, and motion, could hardly serve for the regular development of an important motor-regulating and indicating mechanism, nor for that of a sense organ for functions of such importance and psychical value as the sensation of time and space. If these functions really depended, in the first instance, on the integrity of an organ which evolved and developed under the influence of acoustic stimuli, we should find marked disturbances of motor control, of space and time sense and, of the capacity for understanding number and geometric figures, not only in deaf mutes but in the congenitally deaf or those who became so in early life. This follows of necessity

from an acceptance of v. Cyon's theory, which requires not only a sound labyrinth, but from the side of adequate stimuli, the integrity of the sound perceiving mechanism, for normal function of the organ of the mathematical senses. The agency of a continuous stimulation of the labyrinth by rhythmic internal noises (Geräusche) such as the entotic subjective sensations of sound produced by the heart beat, can hardly be taken seriously. Such stimuli are far too vague, irregular, and purposeless to explain an ordered function of the kind required. We should all have to be laboratory physiologists equipped with special instruments of precision to detect these sensations. In normal conditions we are practically unaware of them. It might be answered that we are similarly unaware of the mechanism of other very important reflexes such as the tactile and sensori-motor reactions, but at least these are constant, uniform, and open to observation. We have no facts which would indicate a control of labyrinthine function, even unconsciously, either by pulse rate or by entotic sensations. Biologically, too, auditory sensations can hardly be made use of as a basis for an adequate stimulus of the semicircular canals, as these sensations have not yet appeared in lower animals which are capable of perfect orientation. The great advantage of the hydro-dynamic theory here, is the regularity, constant action, and elemental force of the source of adequate stimuli, namely gravitation and motion. Here again the objections of v. Cyon apply only to the semicircular canals and not to the maculae, to rotation, and not to gravity and position. His analysis, however ingenious, generally leaves the factor of gravity stress out of consideration entirely, and can easily be met by an interpretation of the facts in terms of the latter factor. A large part of his *reductio ad absurdum* is of a metaphysical nature and can be used against him as well as he has used it against Breuer and Mach. Merely to indicate the quality of v. Cyon's logic, we may mention one or two of his exceptions. Thus, he says, if the semicircular canals are the organ of equilibrium, deaf mutes ought to be born tight-rope walkers, as they will not be subject to vertigo. The answer to this is of course, that the absence of an organ may become evident either through entire loss of function or through disturbance of function. A priori it is impossible to decide which will occur. Congenital absence of the semicircular canals might quite logically produce either of two conditions, loss of balance, and loss of ability to lose balance, congenital vertigo or congenital absence of all vertigo sensations. The same logic applied to v. Cyon's theory itself would require that

deaf mutes should have no conception of time, space, direction, number, or geometry, should be unable to moderate and control the motor functions of the body, and should manifest as a direct result, a constant and marked confusion of sensation and motion. In both instances analysed the main question is whether the function of the labyrinth is to cause sensations and motions or to inhibit and regulate them. Until this fundamental point is decided there will be a possibility of either of two interpretations as there was in the explanations of the reactions after section of the semicircular canals as indications of excitation and of functional paralysis, "Reiz" and "Ausfall," respectively. Many discrepancies could be equalized and a working hypothesis of labyrinthine mechanics as well as a theory of the psychophysical-physiology of balance, direction, and perception of space and time gained by combining the fundamental hydrodynamic data of Breuer-Mach with the teleological interpretation of v. Cyon. The importance of gravity and centrifugal force as constant physiological stimuli must be considered. The direct influence of rotation, active or passive, cannot be replaced by any of v. Cyon's hypothetical stimuli. On the other hand it is only by an application of the sensations produced by these stimuli, in terms of the theory of v. Cyon, to direction that we can explain such general concepts as space, and time, and by the aid of purely acoustic functions of the cochlea, those of number, as well. The metaphysical and philosophic working out of the theory is quite in accord with the view that we have a sense organ for the perception of direction, number, and indirectly of time, and space, and that the conceptions of ideal extent in spatial as well as temporal nature, together with the apodictic axioms of arithmetical processes and geometric systems, depend, not on assumptions, inborn ideas, or aprioristic abstractions, but on very definite sensory impressions which are regulated, systematized and generalized by our conscious psyche, and eventually become a part of our instinctive, i. e., sub-conscious selves.

60 East 58th Street.



### ELONGATED STYLOID PROCESS.

BY CHARLES W. RICHARDSON, M. D., WASHINGTON, D. C.

The abnormal presentation of an elongated styloid process in the tonsillar region is rather an unusual occurrence, if we are to judge from the infrequency of the reported cases, especially when we take into consideration the enormous number of tonsils which are subject to operative intervention. My attention was directed to this subject first through the report of clinical cases by Dr. G. L. Richards and James E. Newcomb. Again, when in 1907 there appeared in the *Annals of Surgery* a most interesting article by Dr. Thomas Dwight on Stylo-Hyoid Ossification. My interest was still further aroused by the presentation during March, 1908, at one of the regular meetings of the Clinico-Pathological Society of Washington, D. C., by Dr. L. W. Glazebrook, of a most rare specimen of complete stylo-hyoid ossification which he had accidentally discovered and removed from the body of a young man who committed suicide by cutting his throat. I regret to state that this specimen became misplaced and has never been rediscovered. A few months later the subject again presented itself to my consideration in a clinical way. In June, 1908, a young woman twenty-five years of age presented herself to me with the following history. She stated that for several years she had had quite an annoying post-nasal catarrh, attended with crust formation. There was quite a degree of soreness and stuffiness in the tonsillar region. She had some difficulty in deglutition and soreness in the neck after much use of the voice. She stated that about a year ago she had consulted one of my colleagues, who had located the trouble from which she suffered in the left tonsil, and, with her consent, had removed it. The removal of the tonsil had been attended with great difficulty on account of "long, slender piece of bone," which was contained in the tonsil. She stated that she had gained great relief from the operation. As the condition had recurred, she came to me for the purpose of having the right tonsil removed. On examination of the faucial region I found on the left side the evidences of a removed tonsil; on the right side a small flat tonsil which hardly projected beyond the pillars. Palpitation demonstrated just within the anterior tonsillar fold, and parallel to its course, a narrow bony ridge. This bony

process was slightly mobile. I recognized I had here to deal with an elongated and abnormally placed styloid process. It is quite probable that the same condition existed upon the left side. I was rather disinclined, at first, to remove the process, but, on finding it tender and painful on pressure, and at the earnest solicitation of the patient, I altered my opinion. In the operation, which I did under cocaine, I opened up the anterior fold its full length and thereby thoroughly exposed the process. The portion extending into the tonsillar region was then removed by three successive bits with a curved bone forceps. The wound healed kindly. In a letter received from the patient some four months later she stated that her throat gave her no trouble and that she never felt better.

In the normal state the styloid process has an average length of about two-and-one-half centimeters and is directed downward, forward and inward from the under surface of the petrous portion of the temporal bone. In order to reach the location in which the styloid extended in the above-described case it must have been between five or six centimeters in length. It is therefore proper to state that the styloid process in this instance was abnormally long. Its course was also somewhat anterior to, and directed more internally, than is usual for the styloid to follow. Dwight gives as the course followed by a bony rod which may extend from the styloid process to the hyoid bone as follows: "This rod passes between the carotid arteries and may interfere with operation for tying them, and with those of the parotid gland, which it probably indents on the inner side. Passing by the internal pytergoid, to which it is attached by the fibrous envelope of that muscle, it lies against the outer side of the tonsil, which it may indent or displace." From the above reason and description of the usual course of the styloid, I should judge that we are correct in stating that the course of the styloid process in this instance was abnormal.

1317 Connecticut Ave.

## REPORT OF CASES ILLUSTRATING OUR PROGRESS IN THE SURGICAL TREATMENT OF CHRONIC STENOSIS OF THE LARYNX AND TRACHEA.

BY JOHN R. WINSLOW, M. D., BALTIMORE, MD.

There is no more difficult chapter in the entire realm of Laryngology, than that on the treatment of chronic stenosis of the larynx and trachea. Many of these cases are excessively rebellious to treatment, requiring patience, persistence, self-sacrifice and skill, on the part of the surgeon, and the endurance of discomfort or even suffering by the patient.

Despite these drawbacks, of such seriousness is the condition, and so imperative the necessity for its amelioration, that we are well compensated for making any sacrifice of time and energy that may be necessary for a successful outcome.

The modern treatment of laryngotracheal stenosis may be said to have begun with L. von Schroetter of Vienna, who in 1871 devised two methods of dilation, the one by means of metal olives after tracheotomy, the other by the use of hollow hard rubber tubes inserted through the mouth, without preliminary tracheotomy: both of these methods have been successfully employed in many cases by numerous operators.

The next great advance in the treatment, was the system of Intubation, invented in 1885 by O'Dwyer of New York, and since then elaborated and universally adopted: this may be employed without tracheotomy, or with tracheotomy, either as simple intubation or associated with fixation of the tube through the fistula (Rogers).

Rapid dilation by means of divulsors (sometimes cutting) or of sounds, introduced through the mouth or tracheotomy wound, seldom gives permanent success, but the combination of divulsion with intubation (Egidi) has proven an invaluable method.

The large number of the older methods seem to be an indication of their inefficiency; when we examine the methods hitherto employed, we find that despite their difficulty and tediousness, none of them guarantees a certain result nor against recurrence of the stricture.

Recently a new method of surgical treatment has been introduced, which seems to offer more hope of certain and adequate results

\*Presented to the American Laryngological Association, Boston, Mass., May 31, June 3, 1909.

in these hitherto intractable conditions than any previous method. I refer to Laryngotracheostomy, originated by Killian and developed by Sargnon and Barlatier of Lyons.

This may be defined as the median vertical fissuring of the larynx and trachea, with the maintenance of a temporary or permanent fistula for a long period. Associated with this is the employment of graduated dilation by means of soft rubber drainage tubes, introduced through the tracheostomy fistula.

My personal experience in the treatment of these cases dates back to the winter of 1891, when I had the privilege in the clinic of Professor Schrotter, of familiarizing myself with his methods. Although I can definitely recall several cases of scleroma and of syphilis treated by me there, as well as a number subsequently at home, I can now find no record of such, and must abstract from a case previously reported (*Jour. Eye, Ear and Throat Dis.* 1896).

*Case 1. A case of Stenosis of the Larynx with Fibroma (?) following a razor cut. Cured by intubation with Schroetter's tubes.*

A negress, twenty-five years of age, was seen by me at the throat dispensary of the University Hospital, August 6, 1892, complaining of and exhibiting marked dyspnoea: this was so aggravated when lying down that she could not sleep in that position. The voice was little affected.

Externally there was a cicatrix in front of but not adherent to the larynx, which she stated was due to a razor slash received at the hands of her lover two and one-half months previously. This was found to have severed the thyroid cartilage and entered the larynx below the vocal chords.

Laryngoscopic examination was difficult owing to dyspnoea and general irritability of the patient, but under cocain anesthesia I finally detected a subchordal stenosis, low down in the larynx, but still exhibiting the thyroid angle: this seemed at first to be almost complete, but upon closer examination the center was seen to be movable and follow the respiratory current.

The apparent size of the growth was that of a small shoe button, fitting the laryngeal lumen like a valve.

The patient was put in the hospital and given spray treatment, and iodide of potassium internally.

After several days, the urgent symptoms having lessened, I began dilation with Schroetter's bougies, under 20 percent cocain anesthesia. The smallest size tube, about that of a large lead pencil, was first introduced, and could only be tolerated a few

moments. Gradually increasing the size of the tube, by the 22nd of September the patient was able to pass the tube herself without cocaine, and retain it indefinitely.

Examination at this time showed that the growth had shrunk considerably, was no longer movable, and that its attachment was to the anterior laryngeal wall.

The treatment was continued, and on October 6th (two months) the patient reported that she could "sleep well and run without losing her breath." Four months later she reported that she breathed easily, except on running rapidly upstairs, and worked regularly at housework.

Examination showed that the stenosis was much dilated and the growth had vanished.

Altogether the patient was under observation about ten months, and has never reported for treatment subsequently.



*Case 2...A case of Laryngostenosis due to double Adenofibroma, treated by Laryngofissure and excision of growths. Cure.*

N. G.—, white, age forty-two, was seen at the Presbyterian Eye, Ear and Throat Hospital, January, 1907.

Complains of hoarseness for past three weeks; has been subject to similar attacks each Winter. During interval says that there is complete restoration of voice. Patient smokes cigars and works in a dusty atmosphere (freight handler).

*Diagnosis:* Sub-acute Laryngitis and Faucitis—Ventricular bands swollen concealing remaining laryngeal structures. Treated with Ag. No. 3 mop and disappeared in a few days. After recovering from this condition patient was re-examined. Voice at this time was strained and almost stridulous; this he designated as its normal condition. Learned subsequently that he had been hoarse at least ten years. Laryngeal examination revealed a fusiform greyish tumor having a smooth surface, attached by a broad base along each ventricular band. Notwithstanding this broad attach-





wing, and the wound held open by an assistant, the field being illuminated with an electric headlight.

Two fusiform tumors were then exposed, resembling the nasal turbinals (polypoid or adrenalinized). These were amputated along their attachment with Struycken's Alligator Turbinal Scissors, and gave the sensation on section, of turbinal tissue. The thyroid plates were secured with catgut, but were so dense that the insertion of the needle was difficult. The muscular layers were united with catgut, the skin with silk. The usual precautions in the after treatment of the respiratory organs were observed.

The temperature and pulse were practically normal until the fourth day after operation, when the temperature rose to 100-1/5; this was found to be due to an infection of the cervical tissues from a slight leakage of the laryngeal wound.

The temperature promptly fell under hot applications, and drainage, but from that time on we had to deal with a suppurating wound of the neck. The thyroid wound healed promptly, and the patient was discharged from the hospital in two weeks, and reported for dressing as indicated. Considerable difficulty was experienced from infected ligatures, which delayed the healing of the neck wound until about August 20th (three months).

The patient was seen and re-examined September 1, 1907. Both chords were then visible and their functions fair, despite some paresis of the vocalis muscles. The voice, while raucous and disagreeable, was strong and intelligible.

Notwithstanding the suppurative accidents, and consequent repeated incisions, a great part of the wound healed per primam, and the disfiguration is slight.

The patient was last seen in the Fall of 1908. He was working and in good health; the voice was rough, but strong. There was no evidence of recurrence of the growths.

#### NOTEWORTHY POINTS.

1. The tumors belonged to the unusual group of Fibro Adenomata. (Prof. Hirsh).
2. Unusually large anterior jugular vein across the thyroid, necessitating ligation.
3. Partial Thyrotomy—No Tracheotomy.
4. Unusual density of thyroid cartilage, making suturing difficult and rendering tight closure of the wound impossible; this resulted in leakage into the tissues of the neck, with neck and ligature infections.

We seem to be afraid of entering the larynx from without, and prefer inexact and incomplete work with the laryngeal mirror.

In many cases of benign tumors, laryngofissure is the conservative and preferable method of removal. Subsequent experience proved that owing to their extent and density, these tumors could not have been removed either by indirect (mirror) or direct laryngoscopy, and that thyrotomy was the appropriate and conservative method of operation.

*Case 3. A case of Stenosis of the Larynx diagnosed by direct Laryngoscopy and successfully treated by Tracheotomy, Retrograde Dilatation, and Intubation: Incidental removal of a foreign body from the Trachea by direct lower Tracheoscopy.*

On November 23, 1907, Mary M—, an Italian schoolgirl, aged eleven years, was sent into the University Hospital from the dispensary by my assistant, Dr. H. C. Davis, with the history of increasing dyspnoea for a month or more, and that for several winters she had had similar attacks. She was poorly nourished, underdeveloped, and could not speak above a whisper. Decided dyspnoea and some cyanosis were present.

November 27, 1907, the patient was anesthetized without difficulty, with chloroform. Every preparation was made for tracheotomy, but suspecting that a condition of laryngeal papilloma might be present, I first introduced the direct speculum through the mouth, and discovered that such was not the case, but that I was dealing with an obstructive condition of indeterminate character, beneath the chords; this was shown by subsequent examination to be a fibrous ridge extending obliquely downward from beneath the left vocal chord.

The entire larynx and trachea were acutely inflamed, and dyspnoea became so alarming that immediate tracheotomy became necessary. The usual after treatment of tracheotomy was carried out, with normal progress until the evening of December 14, when the temperature suddenly rose to 102°, pulse to 160, and respiration 30, with marked dyspnoea; this was found to be due to the improper insertion of the tracheotomy tube after cleansing, between the trachea and the skin, by an assistant. No further incident occurred prior to healing of the wound.

On December 8, 1907, the first intubation was done through the mouth, with a medium-sized tube, which was retained but two hours; this was repeated on the 12th, 13th, and subsequently at varying intervals, by myself or my assistant Dr. Davis, until the discharge of the case on April 14, 1908.

The intubations were done mainly under cocaine; on two occasions intubation was performed through the direct speculum, which was probably one of the earliest uses of this method, but the usual method proved more practicable.

During this period the tracheal cannula was frequently plugged, compelling the patient to breathe through the intubation tube or larynx.

On January 9, 1908, the tracheal wound was enlarged and retrograde dilation performed, under ether, with male urethral sounds up to a No. 8 American, followed by intubation with tubes of increasing size. On February 18, dilation was repeated up to a No. 24 male urethral sound, followed by intubation with the largest size tube of the O'Dwyer's children's set.

Early in the treatment of the case, on account of its chronic character, a hard rubber fenestrated tracheotomy tube had been substituted for the metal one.

At two o'clock in the afternoon of May 6, 1908, while eating cake, the patient was seized with coughing and cyanosis. Upon examination it was found that the tracheal cannula had become unscrewed from its plate and dropped into the trachea. In my absence, this was located at the tracheal bifurcation and skillfully removed under chloroform through the tracheoscope, by my assistant, Dr. R. H. Johnston. Further dilation was not found necessary, as the patient could breathe well with or without the intubation tube.

The tracheotomy wound was allowed to close, and the patient discharged from the hospital April 14, 1908, after a stay of four months and twenty-one days. She was then in good health, and could run and play without dyspnoea; her voice was raucous, but strong.

During her treatment at the hospital and subsequently, she was put upon large doses of Syrup of Iodide of Iron and Iodide of Potassium, with a view to a possible syphilitic taint.

The patient reported at frequent intervals at the dispensary for examination, and was re-examined by me November 23, 1908, which happened to be the anniversary of her entrance into the hospital; at this time she was in good health, breathed well when at rest, and could run up and down a long hall without dyspnoea; her laryngeal lumen was of good size, though somewhat constricted on the left side; it was of an elliptical shape over the posterior two-thirds, and into this a pyramidal mass projected from the inter arytenoid space; the nature of this projection is conjectural, the patient having

been saturated with iodide, and repeatedly examined negatively for tuberculosis, during her stay in the hospital.\*

*Case 4. A case of Post-Typhoidal Laryngotracheal Stenosis, Exfoliation of the Arycartilages and collapse of the Vocal Chords, treated by Laryngotracheostomy, Hémichordectomy and prolonged Intubation; incidental removal of a rubber dilator by direct lower Tracheoscopy.*

F. L.—, white, aged twenty-four years, consulted me on July 24, 1908, with the history of having had typhoid fever three summers previously (Woodberry epidemic). During convalescence, extending over a period of eight weeks, in one of the city hospitals, he was suddenly seized with a coughing spell and spat up two hard conical objects, which were said by the Resident in charge, to be the arytenoid cartilages; thirteen days later he had a severe attack of dyspnoea, necessitating emergency tracheotomy. Ever since that time he has been wearing a silver tracheotomy tube of medium size; while at rest, he can stop up this tube for several hours, but he cannot dispense with it entirely; when active, he can keep the tube stopped for only a short time. He cleans the inner tube himself, but the outer tube has not been removed for two years. He can do no physical labor; is of poor physique, rather haggard, and subject to frequent bronchial colds; his voice is coarse and strained.

*Examination.* A medium size silver tracheotomy tube with no fenestra, is inserted through a fistula above the third tracheal ring, well on the left side; a broad scar indicates a healing of the original wound by granulation.

Laryngeal examination was difficult, but under cocain I was able to discover a double paresis, the chords being relaxed and degenerated, and exhibiting a scarcely appreciable abduction during inspiration; no arytenoid eminences were visible.

The nature and difficulties of the condition were explained to the patient, together with the hopelessness of its treatment by any ordinary measures, and he was allowed to ponder upon the same during my absence on my summer vacation.

Upon my return, he put himself under my care, with full permission to do whatever I considered requisite.

I placed him in the University Hospital, and on October 12, 1908, I enlarged the tracheal fistula and by means of the tracheoscope, determined that there was no obstruction below that level; I also made a direct examination of the larynx from above, with

\*This patient was accidentally seen playing on the street, in excellent health, about June 15, 1909.

Jackson's tube-spatula, gaining no additional information beyond that afforded by the mirror.

October 29, 1908, under combined anesthesia (Scopola-mine gr. 1/100 Morphin Sulph. gr. 1/8—Schleich infiltration) I split the larynx and trachea with a stout knife to the third tracheal ring, then after mopping the laryngotracheal mucous membrane with 10 percent cocain solution in 1/1000 Adrenalin, I removed the left vocal chord in its entirety with Strucken's turbinal scissors; the chord was flabby like a shred of meat.

In performing chordectomy, I was fully aware of the clinical and experimental observations of Citelli and of Fraenkel upon the recrudescence of extirpated vocal chords, but I considered that the recurrence could be removed as often as necessary through the tracheostomy fistula.



Behind the cricoid a narrow stricture, admitting a three-sixteenths catheter, was found, which was not cicatricial, but was due to interstitial hyperplasia of the cartilage.

The mucous membrane of the larynx and most of the trachea was stitched to the skin, but that of the cricoid region was too atrophied and adherent to hold sutures.

The wound-dressing and after treatment were according to the method of Sargnon and Barlatier of Lyons, the details of which will be found in their original communications.

The period of sloughing lasted about six days, that of the subsequent dilation three months.

The first attempt at dilation was made on November 3, 1908; a piece of thick red rubber drainage tubing, bevelled at its lower end

and stuffed with cotton, as devised by Sargnon of Lyons, was inserted through the laryngostomy, and attached by a ligature to the rings of the tracheal cannula; this tube measured one and one-half inches in length, and three-sixteenths of an inch in diameter; it had to be removed upon the following day on account of pain and irritation. A couple of days' rest were allowed, and on November 8th a second tube of the same length, but five-sixteenths of an inch in diameter was inserted. This was retained for thirty-six hours, then removed, cleansed and re-inserted.

On November 15, the diameter of the dilator was again increased to six-sixteenths of an inch. With this tube in position, when the fistula was covered with gauze, the patient could breathe through the tube and the larynx.

The retro-cricoid stenosis yielded with unexpected facility to the dilation, and within a short time a dilator one-half inch in diameter could be inserted; at this stage the type of tube was changed from that of Sargnon to that of Fournier, in which the tracheal cannula is inserted through the rubber dilator; a fenestra was then made in the tracheal cannula, so that the patient could breathe through it and the dilator at will, by occluding the mouth of the tracheotomy tube with a rubber cork.

On the night of November 14, the Fournier tube, though apparently tightly fixed, in some way slipped down the tracheal cannula into the trachea; as this caused no dyspnoea nor alarming symptoms, it was left until the following day, when I removed it under cocain anesthesia through the tracheoscope, with Lister's foreign body hook; this was accomplished with some difficulty, owing to the oscillation of the tube during respiration, between the bifurcation and the tracheal fistula.

The accidents which occurred in these two cases show the necessity for a facility in bronchoscopic methods, in any one who undertakes this work.

Dilation was continued at varying intervals, and for varying periods, according to circumstances, until about January 15, 1909. At this time a subcutaneous abscess developed at the upper angle of the wound over the right side of the thyroid, due to infection, which necessitated a suspension of the dilation, and the patient was transferred to the outdoor department, February 2nd, to be dressed until the fistula had healed.

Special difficulties encountered in the treatment of this case were excessive irritability of the mucous surfaces, even with the use of 20 percent cocain, excessive mouth and laryngeal secretions, amount-



ing at times almost to a flood running down the trachea, and an apparently unconquerable habit in the patient of handling the tubes and dressings, due to the protracted wearing of the tracheotomy tube previously.

#### SECOND PERIOD.

Early in March, 1909, the patient returned for examination, with the abscess healed and the fistula nicely cicatrized. Examination of the larynx at this time showed that the left vocal cord had been replaced by a cicatricial band, but that the laryngeal lumen was greater than before operation.



The patient re-entered the hospital, and on March 15, 1909, I dilated the larynx through the tracheostomy, under cocain, with male sounds consecutively up to No. 28A.

Intubation was then attempted through the mouth, but the tube was not retained.

I then devised a special "T" tube of hard rubber for insertion through the tracheotomy, which has been used ever since, in increasing sizes, and retained for progressively longer periods.

The latter part of April, the patient was discharged from the hospital and has since been treated ambulatory; the tube is readily inserted with or without cocain, and he removes it himself, whenever necessary, coming back to me for reinsertion. After wearing the tube, he is able to breathe through the larynx without it for a variable time (three days, longest time).

I do not know whether he will ever be able to entirely dispense with an intubation tube. The present condition seems to be as

much one of collapse of the laryngeal walls, as of stenosis. The largest male sound may be introduced at any time, but the laryngeal lumen does not remain long open without the tube.

Prolonged intubation seems inevitable; fortunately the larynx will tolerate a rubber intubation tube almost indefinitely. Possibly by forcibly keeping the cords apart by an intubation tube for a long period, they may become shaped so as to maintain a permanent space between them sufficient for breathing.

A repetition of chordectomy does not at present seem justifiable.

The voice without the tube is better than before operation; with the tube in situ, it is forced and suppressed, but thoroughly intelligible.

The patient is still under treatment; he has gained that he is no longer subject to frequent colds, that he is in better general health and is able to do light physical work (painting), and that he seems to feel more like a human being when breathing through the larynx, and has hope; this I share with him, although the case may have been an impossible one from the beginning, and its difficulties may prove to be insuperable.\*

A word in conclusion, upon this new operation: While realizing thoroughly that a single case warrants few conclusions, and that even this one may not have been a fair test of the method, still my experience in it convinces me that we have in Laryngotracheostomy an enormous advance in the treatment of intractable and hitherto often incurable stenosis in these regions. By means of it we can observe and control directly the area of necrosis caused by the pressure of the dilator, an advantage afforded by no other method.

The mortality is under 5 percent, no greater than that of Laryngofissure, to which operation it is, in my opinion, preferable in all cases of grave stenosis.

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\*This case has recently shown marked progress.

## THE TELEPHONE THEORY.\*

BY J. GORDON WILSON, M. D., CHICAGO.

In the time at my disposal to-night it is impossible to discuss fully the telephone theory. I will, therefore, limit myself to a brief review of the main reasons why the supporters of this hypothesis prefer it to the more generally accepted piano or resonance theory.

In the present state of our knowledge with regard to tone perception one is justified in supporting that hypothesis which best explains the known facts in regard to tone perception; which is least in disagreement with the recognized facts of anatomy, physiology and physics; and which at the same time gives the best basis for progressive investigation. This is what is claimed for the telephone theory.

Under the name telephone theory are grouped various shades of hypotheses in regard to tone perception, all of which unite in rejecting the Helmholtz piano or resonance theory as unsatisfactory and all of which agree in these two essentials:

(1) That the membrana basilaris or the membrana tectoria vibrates as a whole.

(2) That while a certain amount of analysis is peripheral, the ultimate analysis is in the cerebrum.

The telephone theory has the support of many of the best physiologists, for instance, Ewald, who has done more than any other physiologist to elucidate the physiology of the ear; of Waller, one of the most distinguished English physiologists. It has the support of some of the best neurologists, for instance, Mott, one of the greatest living neuro-pathologists, and Hardesty, one of the best neurologists in this country. This theory received its first great support, if not its birth, from the work of my old professor of physiology, Rutherford. Since that time it has lost many of its non-essentials and still to-day influences the investigations of some of our best physiologists.

It is agreed that the auditory impulses are conveyed in the acoustic nerve by means of the hair cells of the organ of Corti, probably through the agency of the hairs. That these hairs are not themselves capable of producing suitable vibrations would appear from the fact that their length and arrangement seems to be such as to

\*Read before the Chicago Laryngological and Otological Society, April 13, 1909.

preclude their acting as suitable vibrating structures. Such being the case, we have to seek for some mechanism which will produce suitable vibration of the nerve endings, which are so closely attached to these hair cells, and so offer a reasonable explanation of tone perception.

In order to get a clear idea of what the telephone theory implies it seems best to give the conception of it presented by two of its most prominent exponents. Ewald<sup>1</sup> states it thus: a tone sets the whole basilar membrane into vibration and is analyzed into a series of waves. The totality of these waves (the sound-picture, Schallbild) produces in the brain the tone perception. Each tone corresponds to a characteristic sound-picture. Waller's<sup>2</sup> interpretation of it is very similar: "The basilar membrane vibrates in its entire area to all sounds, though more in some parts than in others, giving what we may designate as acoustic pressure patterns between the membrana tectoria and the subjacent field of hair-cells. So the varying combinations of sound give varying pressure-patterns comparable to the varying retinal images of external objects." Hardesty's<sup>3</sup> conception corresponds to these, applied, however, not to the basilar membrane, but to the tectorial membrane.

The main reasons I would present to you for rejecting the resonance theory as applied to the basilar membrane may be briefly put as follows:—

(1) It is doubtful if this membrane is composed at all of independent fibers. It appears to partake more of the nature of a felt-work of interwoven fibers comparable to what appears in a thin flat tendon.

(2) The radial fibers which do appear are so weighted that they cannot act as resonators.

(3) The resonance theory demands that the cells of the organ of Corti must be capable of moving separately, but it would appear that these cells are intertwined and interwedged so firmly as to be impossible of so acting. (Hardesty<sup>4</sup>).

(4) Physiologically no resonance theory is capable of explaining the phenomenon of tone-perception without suppositions in general physics which have not appealed to some of our best physiologists and physicists. The difficulty in regard to beats has been explained away by assuming that each tone stimulates not one but several neighboring radial fibers—assuming these fibers to be capable of acting as resonators; but no adequate explanation has been offered for what are known as combination tones. The supposition that these

combination tones are due to some formation in the tympanic membrane or the incus-malleus joint is not regarded by many physiologists as satisfactory.

The upbuilding of a theory of resonance with the basilar membrane as the resonating structure has proved so unsatisfactory that the attempt has been made to replace it by the tectorial membrane. To me the objections to the tectorial membrane are even more serious than those which can be applied to the basilar membrane. Passing over the physiological arguments that can be raised against any resonance theory, we have the following fatal objections:

(1) It is obvious that in order to discuss the physiology of a body we must know its anatomical structure. So far anatomists have not been able to offer such information in regard to the tectorial membrane, but differ widely in regard to its formation and its attachments. It is a structure of such supreme delicacy that it offers great barriers to ordinary methods of study; methods of fixation at present at our disposal appear worse than useless.

(2) Physicists declare that even granting those disputed characters which the supporters of this phase of the resonator theory claim to be present in the tectorial membrane, this membrane does not appear capable of acting as a resonator and is not comparable to any resonator known to physics.

It will be noted that these objections to the tectorial membrane are to a certain extent based on a want of definite anatomical knowledge in regard to its structure. Such knowledge is gradually increasing, and to this end the work of Shambaugh has been that of a pioneer. Further investigation may therefore be looked for to confirm or refute these objections; but at present we must note their existence.

The objections which have been made to the basilar membrane as a resonating structure do not apply to the basilar membrane as a vibrating structure. Take each of the above anatomical objections, which I believe to carry the most weight against the resonance theory, not one can be successfully urged against the basilar membrane as a vibrating structure. In short, it is acknowledged to be a structure capable of vibrating.

The principal argument that has been urged against the telephone theory is that it leaves the exceedingly elaborate structure of the organ of Corti out of account (McKendrick<sup>4</sup>). It has always seemed to me that this objection loses much of its force when one considers that the hypotheses of Ewald and of Waller demand such a peripheral mechanism in order to translate the complex sound

waves into corresponding nerve impulses. The physical properties of sound are so totally different from what the physico-chemical properties of nerve impulses appear to be that in order to get the complexities of the sound waves adequately interpreted by the corresponding nerve impulses an intermediary mechanism of considerable complexity must be employed. If the relatively simple sensations of pressure or taste require an elaborate peripheral mechanism to translate the physical or chemical stimulus into a corresponding nerve impulse, how much more elaborate must be the mechanism which translates the complex wave motions of an orchestra into corresponding nerve impulses. Accordingly, the statement that the telephone theory offers no explanation of the organ of Corti seems based on an inadequate conception of the full significance of the hypothesis. At this point one must clearly recognize that the assigning of a degree of peripheral analysis to a vibrating structure is a totally different thing from assuming that the vibrating structure is acting in a manner comparable to a resonator.

In regard to the ultimate analysis of sound, the evidence seems to me to point to its being central. It is a matter of everyday experience that tone perception varies greatly in individuals and is largely a matter of education and imitation. This does not appear to be easily explained, if we assume a constant peripheral non-nervous mechanism for the elaborate differentiation of sound which the resonance theory presupposes. Involved in this question is the difficult and as yet undecided physiological problem of the specificity of nerves—that is, that a nerve fiber only transmits impulses producing one kind of effect. This is a question of vital importance to both the resonance theory and the telephone theory. It appears to me that the modern trend of physiology is towards the belief that the nerve fiber is capable of transmitting not one, but several varieties of nerve impulses. Thus in taste, for example, it would be assumed that there is not one nerve for sweet and another for bitter, but that according to the kind of peripheral irritation at the taste bud, so is the central interpretation which is produced through the medium of the nerve. (Nagel<sup>5</sup>). To go one step further, sugar produces sensations of sweetness, salt of saltiness, but a mixture of sugar and salt produces a sensation totally different from either sweetness or salt. (Nagel<sup>6</sup>). Similar interpretations are also applied to the other senses.

I do not claim that with our present knowledge the telephone hypothesis explains everything physiological and pathological, but I do claim that it offers a sounder basis from which to attack the



complex difficulties of the physiology and the pathology of the auditory nerve than does the resonance theory.

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  6. NAGEL: loc. cit., p. 643.
  7. HARDESTY: loc. cit. p. 156-7.
- Northwestern University Medical School.

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**Cholelithiasis and Pancreatitis.** C. N. SMITH. *Journal A. M. A.*, June 5th, 1906.

The writer states that the prevalence of cholelithiasis and of infections of the biliary tract as the essential feature in the production of pancreatitis demands thoughtful consideration. He enumerates the early symptoms: Pain, shortness of breath, liver tenderness, chills simulating malaria, etc. There is frequently a history of previous typhoid fever. The one great stumbling block in the way of an early diagnosis of gallstone disease, he says, is the allurements of jaundice, which seems to have bewitched the judgment of so many medical men, in that they demand its evidence before admitting the presence of gallstones. Jaundice, however, is an infrequent and inconstant event in gallstone disease, and when present is as a terminal rather than as an inaugural one. Too frequently, indeed, does jaundice announce the advanced stage of a secondary chronic pancreatitis. It is high time that the medical profession should break away from the fetish of jaundice; that it should recognize the presence of gallstones by their inaugural symptoms; that it should appreciate the gravity of gallstone complications and sequels and that it should forestall such complications and sequels by the institution of operative procedures immediately following the establishment of a diagnosis.

## DIRECT INTUBATION OF THE LARYNX.\*

BY HARRIS PEYTON MOSHER, M. D., BOSTON.

For the past year or more I have felt that direct intubation of the larynx was feasible. Cases of sub-glottic infiltration or sub-glottic adhesions and cases of adhesions between the vocal cords are suitable for this procedure. At the last meeting of the American Laryngological Association I presented an instrument which I hoped would accomplish intubation by sight. When the instrument was tried it was only partially successful. Using the experience gained at this trial I constructed a second instrument which I have employed successfully three times. Therefore, I consider direct intubation under ether practical. Needless to say that it is extremely satisfactory because all the manipulations are carried on under direct vision. I do not know whether or not it will ever be advisable to use the procedure without ether. In many cases, however, I am confident that it can be done.

As this is a preliminary note I will give only an outline of the case upon which direct intubation was employed. A little girl was brought to the Massachusetts Charitable Eye and Ear Infirmary suffering from marked difficulty in breathing. Some months before she had an attack of diphtheria and was intubed. Under ether, with the head in the extended position, the child was examined by means of the writer's open speculum. A satisfactory view of the larynx was obtained easily and quickly. It was found that the vocal cords were glued together for two-thirds of the distance from the anterior to the posterior commissure. Having determined the cause of the child's difficulty in breathing, a straight urethrotome was introduced in the space which had remained open between the cords posteriorly and the dilating mechanism was spread antro-posteriorly for three-fourths of an inch. After this a tube suitable for a child seven years was carried by sight into the larynx. Since the first intubation, the procedure has been repeated twice. At the last intubation a tube suitable for a child of nine years was inserted.

For direct intubation but one instrument is used. It both inserts and extracts the tube. It has two Obturators, one fitting four tubes, and one the two largest tubes.

This communication is for the purpose of putting on record the method of treating adhesions between the vocal cords by the urethrotome followed by direct intubation.

828 Beacon Street.

\* A preliminary communication.

## ACUTE ATTIC SUPPURATION WITH HERNIA OF THE DRUM-HEAD LEADING TO TRANSIENT LABYRINTHITIS.\*

BY H. GRADLE, M. D., CHICAGO.

The following observation presents enough unusual features to warrant its report.

Mr. J. C., a healthy man of 38 years, had had an acute attack four weeks previously supposed to have been influenza. A left-sided earache of one night was followed next day by discharge, thick from the beginning, which had not diminished in amount, although never very copious. There was considerable pain irregularly, which had again increased within the last three days. A colleague who had treated him now proposed mastoid operation.

The patient seemed otherwise in good health and had normal temperature. There was variable pain in the ear itself, none behind it, with slight tenderness over the lower part of the mastoid only and scant muco-purulent discharge. The drumhead was hidden by a tumor springing from above and in front and leaving only a narrow chink downward and backward between it and the meatus wall. The tumor, apparently covered with epithelium, felt solid and slightly mobile to the probe. Hearing fair for whisper and watch heard through the air.

In order to prepare for snaring, cocaine and adrenalin were applied and on account of the tenderness were then injected with a fine needle into the tumor. The excessive tenderness on using the needle led me to defer the use of the snare. After the cocaine injection had reduced the sensitiveness to touch I incised the tumor and found it hollow with walls perhaps 3 mm. thick. In catheterizing, air escaped through the incision without expelling any more fluid.

The tumor was evidently a pouch of very much thickened tympanic membrane. Under gauze drainage and instillations of carbolated glycerine the protruding pouch shrank rapidly, and as it receded it became more certain that it was the upper portion of the drumhead. Just before its final disappearance it seemed confined to the flaccid portion, but from its size it seemed scarcely possible that it could be made up merely of Shrapnell's membrane. As

\*Read before the Chicago Laryngological and Otological Society, April 13, 1909.

it receded it gradually uncovered the remainder of the drumhead, which did not seem abnormal except for its congestion.

For a week the pain and discharge diminished rapidly and the mastoid tenderness had practically disappeared. As the pain again increased, and the tumor, now reduced to about one half in size, began to swell again, I made another larger incision into it. As the discharge had shown staphylococci, I also injected subcutaneously staphylococcus vaccine.

From this time on he had no more pain and the diminution of the discharge and the shrinkage of the tumor proceeded at a constant rate.

Nevertheless the man felt sick the next day, and the following night (the tenth day of observation) there occurred labyrinthine involvement. He awoke with involuntary discharge of urine, extreme dizziness and vomiting. The next morning I found normal pulse and temperature, tongue slightly coated and extreme dizziness from the slightest exertion, ceasing only when absolutely quiet on his back. There was no spontaneous nystagmus. Nothing new was learned on inspecting the ear, but the hearing was much reduced. Watch not heard and a very loud whisper uncertain close to the ear. But the tuning fork lateralized on the diseased side.

The dizziness diminished steadily so that five days later he was able to come to the office, though still dizzy on exertion. The ear showed objectively improvement in every way, and the hearing for the voice had also improved. One week after the labyrinthine attack he was able to walk alone, though still slightly dizzy.

The discharge had ceased, catheterization showed an intact drumhead, and, as the catheter relieved him subjectively, it was continued for treatment. The pouch-like protrusion was now limited to the upper posterior part of the drumhead. Steady recovery continued, the dizziness was soon over entirely, and within one month after the onset of the labyrinthine disease, the ear was subjectively and objectively normal with practically perfect hearing.

*Comments.*—The history of four weeks of irregular and intermittent earache suggested inflammation involving mainly the attic of the middle ear. For in acute otitis which is not localized in the attic, pain does not ordinarily continue long, especially after perforation has taken place. The localization in the attic was also confirmed by the scanty muco-purulent discharge which is more profuse when the drum cavity is involved. The discharge was

not examined thoroughly from a bacteriological point of view. A smear showed scant staphylococci.

The diagnosis of the pedunculated tumor protruding beyond the drumhead and occupying the width of the meatus was at first not clear. The mass was pale red, of somewhat irregular surface, but glistening as if covered with epithelium. The latter appearance made it differ from a polypus. But as it was mobile to the probe I intended to snare it. Its great sensitiveness even after the use of cocaine induced me to inject cocaine into its base with a hypodermic needle, the slipping in of which suggested the possibility of a pouch of the drumhead. Incision showed it to be a bag with walls about 3 mm. thick, and the subsequent course confirmed the diagnosis of a pouch of enormously thickened Shrapnell's membrane, which finally returned to the normal. It was not quite clear whether the hernia was limited to Shrapnell's membrane or extended also into the drumhead proper.

Inflammatory pouches are little referred to in literature except by Politzer, who first described them in 1872.\* He does not add much to his first description in the later editions of his text-book, under the headings, "Acute Otitis Media," and "Acute Inflammation of the Attic of the Middle Ear." In his "Atlas d. Beleuchtungsbilder d. Trommelfells," 1896, p. 83, he gives a more detailed description, and shows some illustrations on plate 5. In the "Atlas and Epitome of Otology," by Bruehl and Politzer (1902) there are several illustrations on plate 38 (especially fig. 21). They are scarcely mentioned in most text-books, except by Walb in his article on otitis in Schwartz's *Handbuch der Ohrenheilkunde* (1893). As described by these authors, in the form of small or pedunculated protrusions of Shrapnell's membrane with distinctly purulent contents, they are easily recognized, and I have met with them in a few instances. But a pouch of the exaggerated dimensions seen in this patient I have never known before from personal experience or from the literature. The reason why this condition which had persisted for four weeks improved so rapidly under my treatment was undoubtedly due to better drainage.

Experience in other instances leads me to believe that the subsequently uniform improvement was favored by the staphylococcus vaccination.

The second unusual incident was the involvement of the labyrinth. The sudden occurrence of intense dizziness with initial

\*Ueber Blasenbildungen und Exsudatsaecke im Trommelfell. Wiener Med. Wochenschrift, 1872.

vomiting and nausea indicated beyond doubt a disturbance in the semicircular canals or at least the vestibule. The dizziness was so extreme that the patient scarcely dared to change his position in bed during the first day. An unusual symptom was the involuntary emptying of the bladder at the onset. Yet notwithstanding their great severity the labyrinthine symptoms subsided rapidly and on the third day the patient was able to come to the office with assistance. After the lapse of a week he was only dizzy on sudden exertion.

A similar clinical condition has been described by Alexander (*Archiv f. Ohrenheilkunde*, 1908, Vol. 75, p. 1) as serous labyrinthitis. He observed it in four patients following in each case within twenty-four hours after radical mastoid operation. As in my case, the symptoms arose suddenly and disappeared almost completely within a week. Alexander speaks of spontaneous nystagmus present. This was not observed in my patient. Alexander found the hearing temporarily impaired in one case, not at all in another, while two others had practically been deaf previously. In my patient the hearing, which had been but moderately reduced by the disease of the attic, was very decidedly impaired by the labyrinthine complication. My belief that this was due to involvement of the cochlea is neither supported nor overthrown by the tuning fork test. For in view of the previous interference with sound conduction, one would still expect the fork to be lateralized on the diseased side as long as the cochlear function was only impaired but not abolished. It must be noted, however, that there were no subjective noises. Alexander considers the labyrinthine lesion as a serous effusion, which seems to me probable in view of the sudden onset and the rapid gradual decline. It is not clear what caused the complication in the present case. The patient's subjective and objective improvement came to a standstill two days before the dizziness set in. He began to feel sick and lost appetite but without febrile tendency. The day before the labyrinthine complication I re-opened the incision in the protruding membrane. The improved drainage now permitted again a steady uninterrupted recovery from the attic disease, but perhaps it came too late to prevent the labyrinthine effusion.

No. 100 State Street.



## THE SECOND INTERNATIONAL LARYNGO-RHINOLOGICAL CONGRESS.

*Held at Buda Pest, August 28 to September 4, 1909.*

The permanent committee of the International Laryngo-Rhinological Congress, as organized at the International Congress in Vienna, 1908, consists of the following members:

Chiari (Vienna), Fraenkel (Berlin), Hellat (St. Petersburg), Lefferts (New York), Massei (Naples), Moure (Bordeaux), Semon (London).

In the meeting of the committee, which took place at Buda Pest, August 31, 1909, the absentees, Fraenkel, Hellat and Lefferts, were represented by P. Heymann (Berlin), Lubliner (Warsaw), and Gleitsman (New York).

Sir Felix Semon presented his resignation to the committee, and his place will be taken by Dr. Dundas Grant (London). Semon, by special request of the committee, participates in the present session.

Finder, of Berlin, the editor of the *Internationales Centralblatt für Laryngologie*, is named as secretary of the committee.

The following resolutions were adopted:

1. The next International Laryngo-Rhinological Congress following the present Congress in Buda Pest, will be designated as the Third International Laryngo-Rhinological Congress.
2. The International Laryngo-Rhinological Congresses shall in the future convene in the same city as the International Otological Congresses, either preceding or succeeding the same by several days.
3. The International Laryngo-Rhinological Congress shall convene, if possible, two years after the general International Medical Congress, on condition that the latter convenes every four years.
4. The definite assignment of time and place of the next International Laryngo-Rhinological Congress will be dependent on the next year of meeting of the International Medical Congress.

5. The permanent committee determines the subjects for report and selects the reporters.

6. Each day of the meeting one report will be the order of the day, and two reporters shall be selected to present same.

7. Every reporter is obligated to submit his report to the secretary of the committee at least three months prior to the session of the Congress, in order that it may be translated into the official language of the Congress, and presented in print to the members of the Congress before the Congress convenes.

8. The official languages of the Congress shall be: German, English and French. Should a reporter come up speaking any other language than the above, desire his report printed in his own language, he may undertake the translation and printing of same at his own expense.

9. Each printed report shall not exceed twenty-four printed octavo pages in size.

10. The reading of the printed and presented reports in extenso, shall not be permitted. Each reporter will be allowed twenty minutes in which to present his subject matter at the meeting.

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#### THE EIGHTH INTERNATIONAL OTOLOGICAL CONGRESS.

The Eighth International Otological Congress, held at Buda Pest, August 27 to September 4, marks another important epoch in the development of this progressive specialty of medical science.

The meeting was attended by many of the most distinguished otologists from all parts of the world. We are pleased to note that America was especially well represented by a large delegation.

The scientific work accomplished in Buda Pest included excellent papers and extensive reports of the most recent researches in the otological world. We announce, with much satisfaction, that we have arranged for a very complete report of the scientific transactions of

this Congress for publication in *THE LARYNGOSCOPE*. We will begin the publication of this report as soon as the various papers, presented in the several official languages of the Congress, can be carefully translated into English. Many of the most important papers will appear as original contributions to *THE LARYNGOSCOPE*.

The Ninth Otological Congress will convene in Boston in 1912, under the Presidency of Dr. Clarence J. Blake.

The Lenval prize in otology was awarded to Dr. Heinrich Neumann, of Vienna, and Dr. Albert A. Gray, of Glasgow. This prize is awarded at every International Congress for the best original work presented during the three years interim from one Congress to the next. Honorable mention was also made by the Committee of Award for the work of Dr. Robert Barany.

A magnificent banquet was tendered in Buda Pest to the members of the Congress and their ladies, by the participating Hungarian otologists, and was voted one of the most enjoyable features of the splendid hospitality shown to visiting conferees in Buda Pest. At this banquet Hofrat Professor Politzer announced the establishment of a special prize in otology to be awarded at the International Otological Congresses, and to be known as the Adam Politzer Prize. In view of the unusual interest created at the International Otological Congress, and to give an opportunity for original research and for the public recognition of such work, Prof. Politzer announced his decision to establish a prize similar to the Lenval prize, and to bear his name. The field for original research shall include the anatomy, physiology, and pathology of the organ of hearing. The first award of the Adam Politzer Prize is to be made at the next meeting of the International Otological Congress in Boston, 1912.

The executive committee, representing America at the Ninth International Otological Congress in Boston, as well as the secretary of this Committee, will be announced by President Blake at a later date. The complete list of the permanent executive committee of the International Otological Congress, representing all countries, will be published in a subsequent issue of *THE LARYNGOSCOPE*.

## BOOK REVIEWS.

### Otitic Cerebellar Abscess.

By HEINRICH NEWMANN, Privat-Dozent, University of Vienna. Translated by Richard Lake, F. R. C. S. Small octavo volume, 156 pp.; price, 4 shillings net. Published by H. K. Lewis, 136 Gower street, London, 1909.

Mr. Richard Lake has conferred an especial boon upon English readers by his admirable translation of this important monograph. Among the various authorities in this field of otology, none have had so large an experience as has Neumann. This small volume brings the entire subject matter of otitic cerebellar abscess up-to-date, and includes all important statistics of various authorities; discusses in extenso the technique, the pathology, symptomology, diagnosis, differential diagnosis, and the various methods of operation recommended for the treatment of cerebellar abscess. Functional tests in which the various recent labyrinth tests are embodied, form another feature of this valuable volume. The concluding chapters contain abstract reports of the many cases observed by the author. It is one of the most valuable recent contributions to otological literature, and Mr. Lake deserves the thanks of all American and English otologists for having placed this important subject matter so easily at their command.

### Die Krankheiten des Mundes.

By J. VON MIKULICZ-RADEZKY und W. KUMMEL. Zweite Auflage, Neu Bearbeitet Von W. KUMMEL, Direktor der Universitätsklinik für Ohren-, Nasen-, und Kehlkopfkrankheiten in Heidelberg. Mit Beiträgen von Prof. A. CZERNY, Director des Universitätskinderklinik, und Professor J. SCHAEFFER, in Breslau. Mit 77 zum Teil farbigen Abbildungen im Text. Jena: Gustav Fischer, 1909. Pp. vii-295. (Price, 9 Mk.)

The first edition of this valuable monograph was published during the life-time of Mikulicz-Radetzky and this, the second edition, has been thoroughly revised by his associate in this publication, Professor W. Kummel. The author retains the valuable clinical experience of Mikulicz-Radetzky as the nucleus and basis of this new edition. Many revisions and additions have been made necessary by the development of the pathology of diseases of the mouth and the advances that have been made in Laryngo-Rhinology; in dental pathology; in pediatrics, and dermatology; all of these contributing to this special field.

The chapter on diseases of the mouth in children, has been contributed by Professor Czerny, of Breslau, and Professor Schaeffer has revised the several chapters in which he collaborated in the first edition. A valuable chapter including as complete a bibliography as possible on diseases of the mouth has been added to this edition.

It is by the publication of such complete monographs that the specialty of pathology and surgery of the mouth is gradually being developed into a special field of investigation and work, and we feel assured that a close study of this work will be unusually profitable to every laryngologist.

**Oto-rhino-laryngologie.**

By Drs. CASTEX, University of Paris, Chair of Laryngology, and F. LUBET-BARBON, former interne of the Paris Hospitals. 1 vol., 601 pp., with 215 illustrations. Brochure, 12 fr.; bound, 13 fr., 50. Publishers, J. B. Ballière and Son, 19, Rue Hauteefenille, Paris.

This treatise on oto-rhino-laryngology is by two of the best known specialists of Paris. Dr. Castex, in editing the subject of rhinology and otology, calls attention to the marked progress of recent years in diagnosis and treatment of nasal diseases, due to new technique such as rhinoscopy and transillumination and also to a more perfected series of instruments. Dr. Castex describes the diseases of the nasal fossae, malformations, foreign bodies, rhinitis, catarrh, rhinorrhea, epistaxis, syphilis, tuberculosis, and considers at length the subject of adenoids, as well as affections of all the sinuses. The subject of otology treats of diseases of the middle ear, particularly suppurations, methods of examination of the ear, malformations, diseases of the external and inner ear, the drum membrane, infections of the sinus, the mastoid, Eustachian tube, syphilis and neuroses, and concludes with deafness and deaf-mutism. The particularly interesting contribution of M. Lubet-Barbon deals with laryngology. There is a clear and precise consideration of the pathology, surgical technique of the larynx, methods of exploration, and anaesthesia of the larynx and tracheae, traumatism, contusions, fractures, burns, foreign bodies, inflammatory conditions, abscesses, fistulas, stenoses, tuberculosis, lupus, tumors, laryngotomy, thyrotomy, tracheotomy, laryngocytomy and tubage. This volume forms a part of "New Treatment in Surgery," by Professors Le Dentu and Delbet.

**Die Krankheiten der Oberen Luftwege.**

Vierte, umgearbeitete Auflage von PROFESSOR DR. EDMUND MEYER, in Berlin.  
Mit 180 Textfiguren, 1 Heliogravure und 5 Tafeln in Farbendruck. Verlag von Julius Springer, Berlin, 1909.

The fourth edition of this masterful treatise has just been published. Its revision has been undertaken, by special request of the author some four years ago, by Prof. Dr. Edmund Meyer, of Berlin. The revision thus undertaken, as expressed by the editor, was a very difficult task, inasmuch as the personality of Moritz Schmidt saturated every chapter, and it was only at the special request of the late master, that Meyer undertook the revision of this splendid treatise, preserving as far as possible, the original plan and outline of the author and endeavoring to continue his motto, "Aus der Praxis fuer die Praxis."

The revision includes a description of newer methods and recent researches, the illustration of new instruments and the elimination of more obsolete instrument models. The chapter on general symptomology has been added by the editor, and the chapter on hyperemia and anemia included in same.

Several other chapters have been amalgamated and diseases of the accessory cavities have been developed as a distinct chapter.

The value of the X-ray as a diagnostic aid in diseases of the accessory sinus; the serum diagnosis of syphilis; the conjunctival reaction in tuberculosis; the diseases of the upper respiratory tract in leukaemia and gout, and the character of the cartilages of the larynx in these conditions, have been extensively elaborated. Case reports, specimens, and illustrations of the Berlin University clinic for nose and throat diseases have been liberally used in the revised volume.

In its revised form this important treatise has assumed additional value and strength, for it incorporates all of the advances in Rhino-Laryngology, with the grand principles and plan of work as originally set forth by Moritz Schmidt.

**Pathologie und Therapie der Entzündlichen Erkrankungen der Nebenhöhlen der Nase.**

By DR. M. HAJEK, Privat-Dozent an der k. k. Universität Wien, Mit 150 Abbildungen, grösstenteils nach eigenen Originalen und 2 Tafeln in Lichtdruck. Dritte, vermehrte Auflage. Leipzig und Wien, Franz Deuticke, 1909.

The third edition of this splendid classic has just appeared. Since the publication of the second edition six years ago, the unusual activities in the pathologic treatment and surgical technique of the accessory sinuses has made a complete revision of this valuable treatise necessary. Valuable additions have been made to nearly every chapter and some of the opinions advanced in previous chapters, then in the formative stage, have been elaborated, or more definitely presented.

The chapters on operative technique in the treatment of chronic diseases of the accessory sinuses and the indications for operations have been completely rewritten. The chapters on the diagnosis and endo-nasal surgery of the inflammatory diseases of the sphenoid cavity, and the posterior ethmoid labyrinth, as advanced by Hajek in recent monograph, have been added to this volume.

The chapter on orbital and cerebral complications has been very extensively elaborated. The volume has increased in size from 361 pages of the previous edition, to 443 pages of the present edition; many new illustrations have been added to the text, especially those to elucidate operative technique. Two radiograph plates illustrative of suppurative processes in the accessory cavities, have also been included.

It is a masterful volume and no laryngologist can afford to be without it.

**Uebungsbuch fuer Schwerhoerige und Ertaubte, das Ablezen vom Munde.**

By FRANZ XAVER RÖTZER, Lehrer am Königlichen Zentral-Taubstummen-Institut München. Mit 16 Lauttafeln. München und Berlin, Druck und Von R. Oldenbourg. 1908.

This practical little book of fifty-two pages is a working manual for instruction by the lip reading system of deaf mutes, and those so deficient in hearing that such a course of training is necessary.

Unfortunately much of its force is lost to those of us who conduct the lip reading system of training the deaf in the English language, as the system is distinctly applied to the German language. There is much, however, that may be gleaned from these pages to be of distinct aid to our own work in this direction.

Sixteen full page plates are included in this manual illustrating the position of the mouth, lips, teeth, palate, and tongue in the formation of the various vowels and consonants.

All otologists engaged in following up cases where the lip reading system has been devised, should familiarize themselves with the detail of this book.



